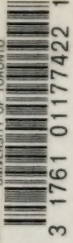
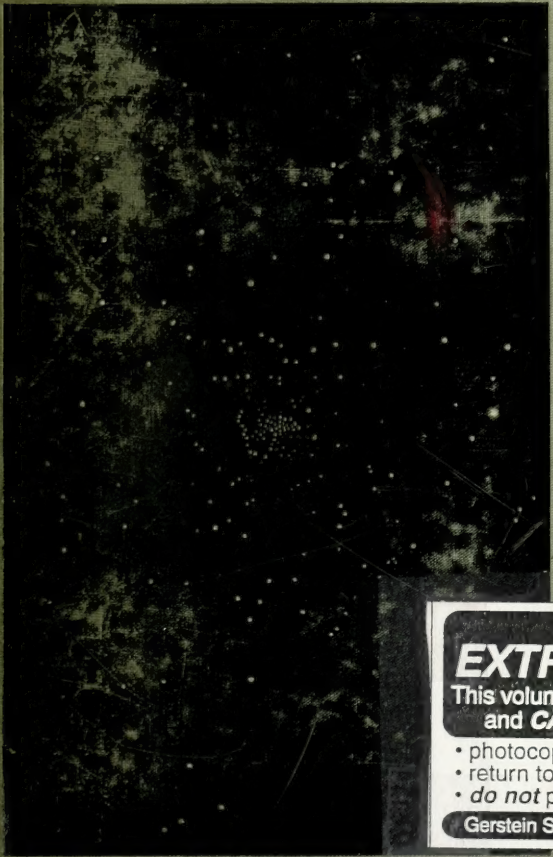


UNIVERSITY OF TORONTO



# STAR ATLAS

3<sup>RD</sup> EDITION. REVISED & ENLARGED



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BY

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BY

DR. HERMANN J. KLEIN.

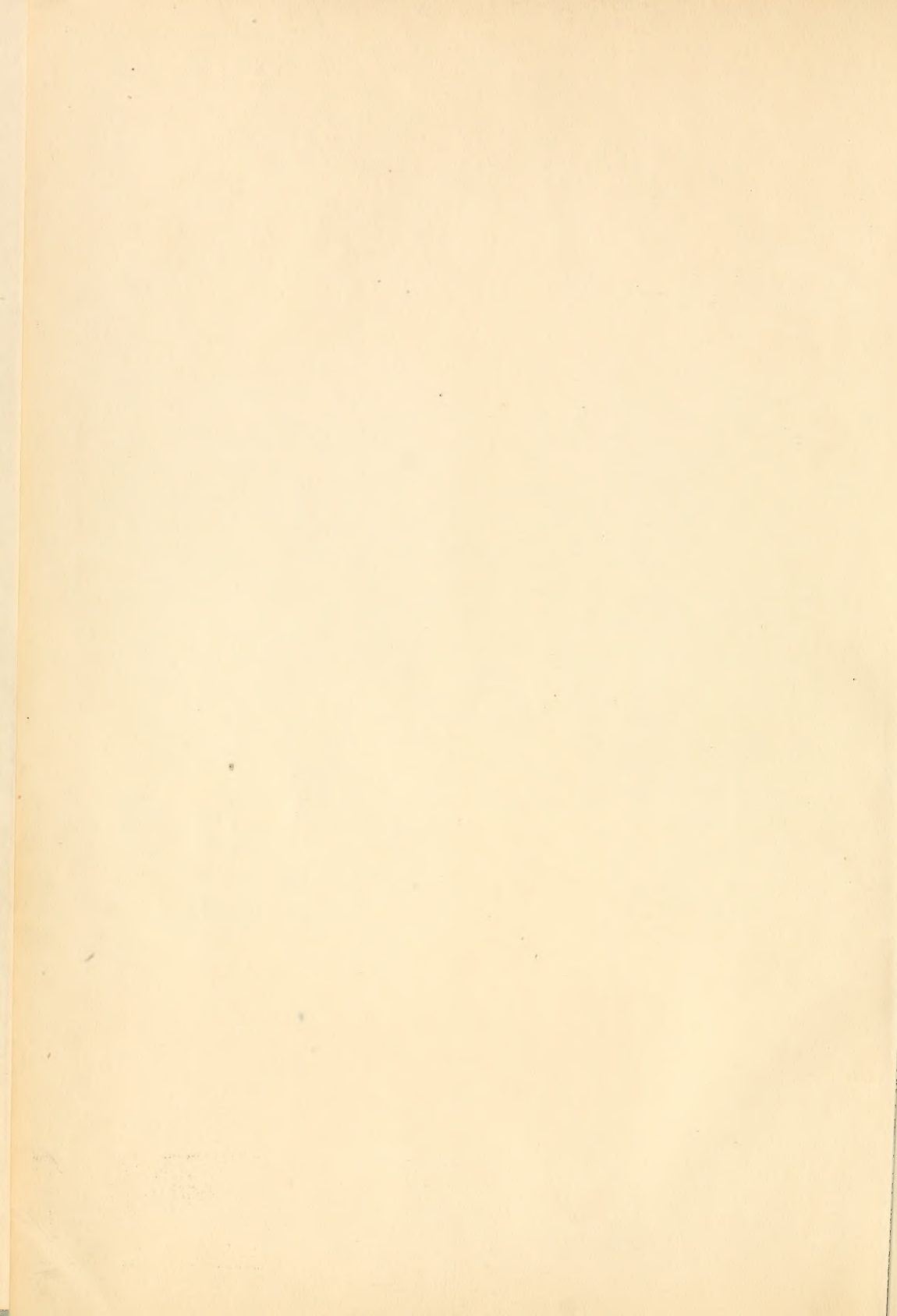
EDMUND M<sup>C</sup>CLURE MA., M.R.I.A., F.L.S.

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NEW YORK: E. & J. B. YOUNG & CO  
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# STAR ATLAS

CONTAINING

MAPS OF ALL THE STARS FROM 1 TO 6.5 MAGNITUDE BETWEEN THE  
NORTH POLE AND 34° SOUTH DECLINATION, AND OF ALL  
NEBULÆ AND STAR CLUSTERS IN THE SAME  
REGION WHICH ARE VISIBLE IN  
TELESCOPES OF MODERATE  
POWERS.

*WITH EXPLANATORY TEXT*

BY

DR. HERMANN J. KLEIN.

TRANSLATED BY

EDMUND McCLURE, M.A., M.R.I.A., F.L.S.

WITH EIGHTEEN MAPS

PRINTED BY E. A. FUNKE, LEIPSIQ.

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FROM PREFACE TO PREVIOUS EDITION.

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DR. ANDERSON, the discoverer of the *Nova* in *Auriga*, and of many variable stars, including the *Nova Persei* in this year, writing to *Nature*, February 18th, 1892, says: "You might also allow me to state, for the benefit of your readers, that my case is one that can afford encouragement to even the humblest amateurs. My knowledge of the technicalities of Astronomy is, unfortunately, of the meagrest description; and all the means at my disposal on the morning when I was sure that a strange body was present in the sky, were KLEIN'S 'STAR ATLAS' and a small pocket telescope which magnifies ten times."

---

AUTHOR'S PREFACE TO NEW EDITION.

---

THIS Edition of the "STAR ATLAS" has, as far as the text is concerned, been fully revised, and considerably enlarged. Not only are all the objects which are discussed brought into their correct positions for 1900, but the numbering of the nebulae in accordance with the new General Catalogue has been made an additional feature. Lastly, the number of described objects has been considerably increased, and the results of the most recent investigations and measurements have been fully kept in view. It is not, therefore, too much to say that this "STAR ATLAS" will commend itself to the many who are now interested in the study of the sublime heavens, as a trustworthy source of information, and as a guide conversant with the latest developments of astronomical science.

April, 1901.

QB  
65  
K453  
1901

# TABLE OF CONTENTS.

	PAGE		PAGE		PAGE
Introduction . . . . .	1	69 Double Star . . . . .	73	Σ 196 Quadruple Star . . . . .	16
Table for turning Sidereal Time into Degrees . . . . .	2	τ " " . . . . .	73	14 Triple Star . . . . .	17
Table for turning Degrees into Sidereal Time . . . . .	3	S Variable . . . . .	73	R Variable . . . . .	17
Sidereal Time at Mean Noon . . . . .	4	ψ Double Star . . . . .	73	30 Double Star . . . . .	18
Constellations . . . . .	5	94 " " . . . . .	73	33 " " . . . . .	18
Star Magnitudes . . . . .	6	R Variable . . . . .	74	T Variable . . . . .	18
Number of the Fixed Stars . . . . .	7	107 Double Star . . . . .	74	π Triple Star . . . . .	18
Variable Stars . . . . .	8	<b>Aquila, The Eagle.</b>			
Distance of the Fixed Stars . . . . .	8	(Sheet VI., XI., XII.)			
Double Stars . . . . .	8	5 Double Star . . . . .	61	<b>Auriga, The Waggoner.</b>	
Star Clusters . . . . .	9	4440 Star Cluster (Sheet XV.) . . . . .	62	(Sheet I., II., III.)	
Nebulae . . . . .	10	11 Double Star . . . . .	63	4 Double Star . . . . .	23
Explanation of the Maps . . . . .	10	h " " . . . . .	63	ε Variable . . . . .	23
Description of the more interesting Fixed Stars, Star Clusters and Nebulae . . . . .	11	R Variable . . . . .	63	996 Star Cluster . . . . .	24
<b>Andromeda.</b>					
(Sheet II., V., VI.)					
R Variable . . . . .	11	4470 Star Cluster . . . . .	63	Σ 645 Double Star . . . . .	24
116 Nebula . . . . .	12	4482 " " . . . . .	63	R Variable . . . . .	24
117 " " . . . . .	13	23 Double Star . . . . .	63	α Capella . . . . .	24
μ Double Star . . . . .	14	4487 Nebula . . . . .	63	14 Triple Star . . . . .	25
457 Star Cluster . . . . .	16	Nova . . . . .	64	λ " " . . . . .	25
γ Triple Star . . . . .	16	χ Double Star . . . . .	64	1067 Star Cluster . . . . .	25
527 Nebula . . . . .	17	π " " . . . . .	64	Σ 681 Double Star . . . . .	25
575 " " . . . . .	18	α Altair . . . . .	65	1101 Star Cluster . . . . .	26
4964 " " . . . . .	74	η Variable . . . . .	65	1114 " " . . . . .	26
λ Spectroscopic Double . . . . .	74	β Multiple Star . . . . .	65	1119 " " . . . . .	26
3050 Double Star . . . . .	74	57 Double Star . . . . .	65	1137 Nebula . . . . .	26
<b>Aquarius, The Water Bearer.</b>					
(Sheet XII.)					
1 Triple Star . . . . .	68	Σ 2628 Double Star . . . . .	66	Nova . . . . .	26
T Variable . . . . .	68	Σ 2644 " " . . . . .	66	1166 Star Cluster . . . . .	27
4 Double Star . . . . .	69	Σ 2654 " " . . . . .	66	26 Double Star . . . . .	29
4628 Nebula . . . . .	69	<b>Argo navis, The Ship Argo.</b>			
12 Double Star . . . . .	69	(Sheet VIII., IX.)			
4678 Nebula . . . . .	71	Σ 1097 Quintuple Star . . . . .	36	1295 Star Cluster (Sheet XVIII.) . . . . .	31
41 Double Star . . . . .	72	Σ 1121 Double Star . . . . .	36	β Revolving Star . . . . .	31
ζ " " . . . . .	72	1551 Star Cluster . . . . .	36	θ Triple Star . . . . .	31
<b>Aries, The Ram.</b>					
(Sheet II., VII.)					
γ Double Star . . . . .	16	1564 " " . . . . .	37	41 Double Star . . . . .	31
λ " " . . . . .	16	1567 Nebula . . . . .	37	Σ 872 " " . . . . .	32
<b>Bootes.</b>					
(Sheet III., IV., V., X.)					
1 Double Star . . . . .	49	1571 Star Cluster . . . . .	37	Star with Hydrocarbon Bands . . . . .	33
τ " " . . . . .	49	5 Double Star . . . . .	37	56 " " . . . . .	33
T Variable . . . . .	49	1630 Star Cluster . . . . .	38	1451 Star Cluster . . . . .	34
κ Double Star . . . . .	49	1632 Star Nebula . . . . .	38		

	PAGE
$\mu$ Double Star . . . . .	49
$\alpha$ Arcturus . . . . .	49
$\iota$ Double Star . . . . .	49
$S$ Variable . . . . .	49
$\Sigma$ 1850 Double Star . . . . .	49
$R$ Variable . . . . .	50
$\pi$ Double Star . . . . .	50
$\zeta$ Triple Star . . . . .	50
$\epsilon$ Double Star . . . . .	50
$\xi$ " . . . . .	50
39 " . . . . .	50
44 " . . . . .	50
$\Sigma$ 1919 " . . . . .	51
$\Sigma$ 1926 " . . . . .	51
$\delta$ " . . . . .	51
$\mu$ Triple Star . . . . .	52

**Camelopardalis, The Giraffe.**

(Sheet I., II., III., IV., VI.)

$\Sigma$ 385 Double Star . . . . .	20
$\Sigma$ 390 " . . . . .	20
$\Sigma$ 396 " . . . . .	20
801 Nebula . . . . .	21
$\Sigma$ 485 Double Star . . . . .	21
1 " . . . . .	22
2 " . . . . .	23
7 Triple Star . . . . .	23
940 Star Cluster . . . . .	23
$\Sigma$ 634 Double Star . . . . .	24
$\Sigma$ 780 Triple Star . . . . .	30
$\Sigma$ 1051 " . . . . .	35
1541 Nebula . . . . .	36
$\Sigma$ 1127 Triple Star . . . . .	37
1691 Nebula . . . . .	39

**Cancer, The Crab.**

(Sheet III., IV., IX.)

$\zeta$ Triple Star . . . . .	38
$R$ Variable . . . . .	38
$V$ " . . . . .	38
$\phi^2$ Double Star . . . . .	38
$v^1$ " . . . . .	38
$\xi$ " . . . . .	38
1681 Star Cluster . . . . .	38
$S$ Variable . . . . .	38
$\iota$ Double Star . . . . .	39
1712 Star Cluster . . . . .	39
1713 Nebula . . . . .	39
$\sigma^2$ Double Star . . . . .	39
$\alpha$ " . . . . .	39
66 " . . . . .	39
67 " . . . . .	39
$\Sigma$ 1311 " . . . . .	39

**Canes venatici, The Hounds.**

(Sheet III., IV., V.)

2723 Nebula . . . . .	44
$\Sigma$ 1606 Double Star . . . . .	44
2 " . . . . .	44
2972 Nebula . . . . .	45
3002 " . . . . .	45

	PAGE
3041 Nebula . . . . .	45
3165 " (Sheet XVIII.) . . . . .	46
3258 " . . . . .	47
12 Double Star . . . . .	47
15, 17 " . . . . .	47
3437 Nebula . . . . .	48
3474 " . . . . .	48
3572 " (Sheet XVI.) . . . . .	48
25 Double Star . . . . .	49
3636 Star Cluster . . . . .	49
3637 Nebula . . . . .	49

**Canis major, The Great Dog.**

(Sheet VIII.)

$\alpha$ Sirius . . . . .	33
1454 Star Cluster . . . . .	34
$\mu$ Double Star . . . . .	34
1479 Star Cluster . . . . .	34
$\gamma$ Variable . . . . .	35
$\delta$ " . . . . .	35
1511 Nebula (Sheet XVIII.) . . . . .	35
1512 Star Cluster . . . . .	35
$R$ Variable . . . . .	35
1513 Star Cluster . . . . .	35

**Canis minor, The Little Dog.**

(Sheet VIII.)

$R$ Variable . . . . .	35
$S$ " . . . . .	36
$\alpha$ Procyon . . . . .	36
14 Triple Star . . . . .	38
1617 Nebula . . . . .	38

**Capricornus, The He Goat.**

(Sheet XII.)

$a^1 a^2$ Double Star . . . . .	66
$\sigma$ " . . . . .	67
$\beta$ " . . . . .	67
$\pi$ " . . . . .	67
$\rho$ " . . . . .	67
4608 Star Cluster . . . . .	69
4687 " . . . . .	71

**Cassiopeia.**

(Sheet I., II., III., V., VI.)

$\beta$ Double Star . . . . .	11
$T$ Variable . . . . .	11
Nova of 1572 (Sheet XVIII.) . . . . .	11
63 Star Cluster . . . . .	11
68 " . . . . .	12
$\alpha$ Variable . . . . .	12
120 Star Cluster . . . . .	13
$\eta$ Double Star . . . . .	13
$\gamma$ " . . . . .	13
$S$ Variable . . . . .	14
256 Star Cluster (Sheet XVII.) . . . . .	14
$\psi$ Triple Star . . . . .	15
341 Star Cluster . . . . .	15
392 " (Sheet XVII.) . . . . .	16
$\iota$ Triple Star . . . . .	17
5031 Star Cluster (Sheet XVII.) . . . . .	74
$R$ Variable . . . . .	74
$\sigma$ Double Star . . . . .	74

**Centaurus, The Centaur.**

(Sheet X.)

[The important stars in this southern constellation are beyond the scope of this Atlas.]

**Cepheus.**

(Sheet I., II., V., VI.)

	PAGE
$U$ Variable . . . . .	14
$\Sigma$ 460 Double Star . . . . .	21
$\kappa$ " . . . . .	67
4590 Star Cluster . . . . .	67
$\eta$ Double Star . . . . .	68
$T$ Variable . . . . .	70
$\Sigma$ 2780 Double Star . . . . .	70
$\Sigma$ 2790 " . . . . .	70
$\beta$ " . . . . .	71
$\Sigma$ 2816 " . . . . .	71
$S$ Variable . . . . .	71
$\mu$ " . . . . .	72
4709 Star Cluster . . . . .	72
$\Sigma$ 2840 Double Star . . . . .	72
$\xi$ " . . . . .	72
$\Sigma$ 2872 " . . . . .	72
$\Sigma$ 2883 " . . . . .	72
$\Sigma$ 2893 " . . . . .	72
$\delta$ Variable . . . . .	72
$\pi$ Triple Star . . . . .	73
$\sigma$ Double Star . . . . .	73
4957 Star Cluster . . . . .	73

**Cetus, The Whale.**

(Sheet VII.)

$S$ Variable . . . . .	11
138 Nebula . . . . .	13
26 Double Star . . . . .	14
$\eta$ " . . . . .	14
42 " . . . . .	14
342 Nebula . . . . .	15
361 " . . . . .	15
$\chi$ Double Star . . . . .	16
$\sigma$ (Mira) Variable . . . . .	17
$R$ " . . . . .	18
544 Planetary Nebula . . . . .	18
$\nu$ Double Star . . . . .	18
600 Nebula . . . . .	18
604 " . . . . .	18
94 Double Star . . . . .	19

**Columba, The Dove.**

(Sheet VIII.)

**Coma Berenices, Berenice's Hair.**

(Sheet IV., X.)

2 Double Star . . . . .	44
2752 Star Cluster . . . . .	44
2786 Nebula . . . . .	44
2838 " . . . . .	44
12 Double Star . . . . .	45
2890 Nebula . . . . .	45
2946 " . . . . .	45
17 Double Star . . . . .	45
3043 Nebula . . . . .	45
24 Double Star . . . . .	45



	PAGE
3101 Nebula . . . . .	46
3106 " " " " " "	46
Σ 1678 Double Star . . . . .	47
35 " " " " " "	47
3342 Nebula . . . . .	47
42 Double Star . . . . .	47
3453 Star Cluster . . . . .	47

**Corona borealis, The Northern Crown.**

(Sheet IV., V., VI.)

Σ 1932 Double Star . . . . .	51
<i>U</i> Variable . . . . .	51
<i>S</i> " " " " " "	51
η Double Star . . . . .	51
Σ 1964 " " " " " "	52
ζ " " " " " "	52
γ " " " " " "	52
<i>R</i> Variable . . . . .	52
λ Double Star . . . . .	52
<i>S</i> " " " " " "	52
<i>T</i> Nova . . . . .	52
σ Double Star . . . . .	53
<i>v</i> Multiple Star . . . . .	53

**Corvus, The Crow.**

(Sheet IX., X.)

<i>R</i> Variable . . . . .	45
δ Double Star . . . . .	45

**Crater, The Cup.**

(Sheet XII.)

**Cygnus, The Swan.**

(Sheet I., II., V., VI.)

β Variable . . . . .	64
φ Triple Star . . . . .	64
<i>R</i> Variable . . . . .	64
4511 Star Cluster . . . . .	64
16 Double Star . . . . .	64
δ " " " " " "	64
4514 Nebula . . . . .	64
17 Double Star . . . . .	64
χ Variable . . . . .	65
4517 Star Cluster . . . . .	65
η Multiple Star . . . . .	65
ψ Double Star . . . . .	66
ε Triple Star . . . . .	66
4544 Star Cluster . . . . .	66
α <sup>2</sup> Double Star . . . . .	66
<i>P</i> Variable . . . . .	67
γ Triple Star . . . . .	67
4575 Star Cluster . . . . .	67
α <sup>2</sup> Double Star . . . . .	67
49 " " " " " "	68
4600 Nebula . . . . .	68
52 Double Star . . . . .	68
<i>T</i> Variable . . . . .	68
λ Triple Star . . . . .	68
59 Double Star . . . . .	69
f <sup>1</sup> Triple Star . . . . .	69

	PAGE
61 Double Star . . . . .	69
Nebula . . . . .	70
4645 Star Cluster . . . . .	70
τ Double Star . . . . .	70
<i>v</i> " " " " " "	70
4681 Star Cluster . . . . .	71
Nova 1876 . . . . .	71
μ Quadruple Star . . . . .	71

**Delphinus, The Dolphin.**

(Sheet V., XII.)

4586 Nebula . . . . .	67
β Triple Star . . . . .	68
α Multiple Star . . . . .	68
<i>T</i> Variable . . . . .	68
γ Double Star . . . . .	68
4625 Nebula . . . . .	69

**Draco, The Dragon.**

(Sheets I., III., IV., V., VI.)

2024 Nebula . . . . .	41
4029 " " " " " "	50
ε Double Star . . . . .	52
Σ 1984 " " " " " "	52
99 " " " " " "	54
η " " " " " "	54
16, 17 " " " " " "	54
μ " " " " " "	56
<i>v</i> " " " " " "	57
ψ " " " " " "	58
γ " " " " " "	58
4373 Nebula . . . . .	59
40, 41 Double Star . . . . .	59
φ " " " " " "	60
39 <i>b</i> " " " " " "	60
4415 Nebula . . . . .	60
χ Spectroscopic Double . . . . .	60
Σ 2403 Double Star . . . . .	62
ε " " " " " "	65

**Equuleus, The Foal.**

(Sheet XII.)

Σ 2735 Double Star . . . . .	69
1 Triple Star . . . . .	69
2 Double Star . . . . .	69
Σ 2744 " " " " " "	69
γ Triple Star . . . . .	70
δ " " " " " "	70
β Multiple Star . . . . .	70

**Eridanus, The River**

**Eridanus.**

(Sheet VII., VIII.)

ε <sup>2</sup> Eridani . . . . .	19
12 Double Star . . . . .	19
692 Nebula . . . . .	20
709 " " " " " "	20
Σ 422 Double Star . . . . .	20
32 " " " " " "	21
<i>A</i> " " " " " "	22

	PAGE
826 Nebula . . . . .	22
α <sup>2</sup> Triple Star . . . . .	22
55 Double Star . . . . .	23
<i>b</i> " " " " " "	23

**Gemini, The Twins.**

(Sheet II., III., VIII.)

1325 Star Cluster . . . . .	31
1360 " " " " " "	31
η Variable . . . . .	32
μ Double Star . . . . .	32
15 " " " " " "	32
γ Triple Star . . . . .	33
ε Double Star . . . . .	33
38 " " " " " "	34
1467 Star Cluster . . . . .	34
ζ Variable . . . . .	34
<i>R</i> " " " " " "	35
1490 Star Cluster . . . . .	35
1508 " " " " " "	35
λ Double Star . . . . .	35
δ " " " " " "	35
1534 Star Cluster . . . . .	36
α Double Star . . . . .	36
1549 Star Cluster . . . . .	36
<i>S</i> Variable . . . . .	37
κ Double Star . . . . .	37
β Multiple Star . . . . .	37
π Double Star . . . . .	37
<i>T</i> Variable . . . . .	37
<i>U</i> " " " " " "	38

**Hercules.**

(Sheet I., IV., V., VI., XI.)

Σ 2007 Double Star . . . . .	53
κ " " " " " "	53
γ " " " " " "	54
<i>U</i> Variable . . . . .	54
30, <i>g</i> " " " " " "	54
<i>m</i> Double Star . . . . .	54
42 " " " " " "	54
ζ " " " " " "	54
4230 Star Cluster (Sheet XVII., XVIII.) . . . . .	55
4234 Nebula . . . . .	55
Σ 2101 Double Star . . . . .	55
4244 Nebula . . . . .	55
Σ 2104 Double Star . . . . .	55
<i>S</i> Variable . . . . .	55
α " " " " " "	56
δ Double Star . . . . .	56
4294 Star Cluster (Sheet XV.) . . . . .	57
68, <i>u</i> Variable . . . . .	57
ρ Double Star . . . . .	57
Σ 2190 " " " " " "	57
83 " " " " " "	57
Σ 2215 " " " " " "	58
μ Triple Star . . . . .	58
4343 Nebula . . . . .	58
95 Double Star . . . . .	58
Σ 2277 " " " " " "	59

	PAGE
99 Double Star . . . . .	59
100 " " " " " " . . . . .	59
<i>T</i> Variable . . . . .	59
Σ 2289 Double Star . . . . .	59
110 " " " " " " . . . . .	62

**Hydra.**

(Sheet IX., X.)

Σ 1245 Double Star . . . . .	38
ε Multiple Star . . . . .	39
15 Triple Star . . . . .	39
<i>S</i> Variable . . . . .	39
<i>T</i> " " " " " " . . . . .	39
ζ Double Star . . . . .	40
τ <sup>1</sup> " " " " " " . . . . .	40
2102 Nebula . . . . .	41
Double Star . . . . .	43
3128 Nebula . . . . .	46
<i>R</i> Variable . . . . .	48

**Lacerta, The Lizard.**

(Sheet II., V.)

4755 Star Cluster (Sheet XVII.) . . . . .	72
4773 " " " " " " . . . . .	72
8 Quadruple Star . . . . .	73

**Lepus, The Hare.**

(Sheet VIII.)

<i>R</i> Variable . . . . .	24
ι Double Star . . . . .	24
κ " " " " " " . . . . .	25
ζ Triple Star . . . . .	25
1112 Star Cluster . . . . .	26
β Multiple Star . . . . .	26
α Double Star . . . . .	27
45 Multiple Star . . . . .	30
γ Double Star . . . . .	30

**Leo, The Lion.**

(Sheet III., IV., IX.)

ο Double Star . . . . .	40
1861 Nebula . . . . .	40
1863 " " " " " " . . . . .	40
6 Double Star . . . . .	40
7 " " " " " " . . . . .	40
ο Spectroscopic Double . . . . .	40
<i>R</i> Variable . . . . .	41
α Regulus . . . . .	41
γ Double Star . . . . .	41
49 " " " " " " . . . . .	42
2184 Nebula . . . . .	42
2194 " " " " " " . . . . .	42
2203 " " " " " " . . . . .	42
2207 " " " " " " . . . . .	42
54 Double Star . . . . .	42
2279 Nebula . . . . .	42
2301 " " " " " " . . . . .	42
2352 " " " " " " . . . . .	43
2373 " " " " " " . . . . .	43
2377 " " " " " " . . . . .	43

	PAGE
ι Double Star . . . . .	43
τ " " " " " " . . . . .	43
88 " " " " " " . . . . .	43
90 " " " " " " . . . . .	43
93 " " " " " " . . . . .	43
β Multiple Star . . . . .	43

**Leo minor, The Little Lion.**

(Sheet III., IV.)

<i>R</i> Variable . . . . .	41
2104 Nebula . . . . .	41
2178 " " " " " " . . . . .	42
2274 " " " " " " . . . . .	42
2287 " " " " " " . . . . .	42

**Libra, The Balance.**

(Sheet X., XI.)

μ Double Star . . . . .	50
α " " " " " " . . . . .	50
Multiple Star . . . . .	50
δ Variable . . . . .	50
ι Triple Star . . . . .	50
<i>S</i> Variable . . . . .	51
Σ 1962 Double Star . . . . .	52

**Lupus, The Wolf.**

(Sheet X., XI.)

4 Double Star . . . . .	32
5 Triple Star . . . . .	32
12 " " " " " " . . . . .	33
Σ 958 Double Star . . . . .	33
14 " " " " " " . . . . .	34
Σ 1009 " " " " " " . . . . .	34
19 " " " " " " . . . . .	35
Σ 1333 " " " " " " . . . . .	40
38 " " " " " " . . . . .	40
1811 Nebula . . . . .	40
39 Double Star . . . . .	40
41 " " " " " " . . . . .	40

**Lynx.**

(Sheet I., II., III., IV.)

4 Double Star . . . . .	32
5 Triple Star . . . . .	32
12 " " " " " " . . . . .	33
Σ 958 Double Star . . . . .	33
14 " " " " " " . . . . .	34
Σ 1009 " " " " " " . . . . .	34
19 " " " " " " . . . . .	35
Σ 1333 " " " " " " . . . . .	40
38 " " " " " " . . . . .	40
1811 Nebula . . . . .	40
39 Double Star . . . . .	40
41 " " " " " " . . . . .	40

**Lyra, The Lyre.**

(Sheet IV., V., VI.)

α Vega . . . . .	61
ε and 5 Double Stars . . . . .	61
ζ Double Star . . . . .	61
β Variable . . . . .	62
4447 Ring Nebula (Sheet XVI.) . . . . .	62
Multiple Star . . . . .	63
<i>R</i> Variable . . . . .	63
17 Double Star . . . . .	63
η " " " " " " . . . . .	63
4482 Star Cluster . . . . .	63
4485 " " " " " " . . . . .	63
ζ Double Star . . . . .	63

**Monoceros, The Unicorn.**

(Sheet VIII., IX.)

	PAGE
4 Triple Star . . . . .	31
5 Red Star . . . . .	32
8 Double Star . . . . .	32
<i>T</i> Variable . . . . .	32
1408 Star Cluster . . . . .	32
1415 " " " " " " . . . . .	32
11 Quadruple Star . . . . .	32
Σ 921 Double Star . . . . .	32
1424 Star Cluster . . . . .	33
1425 Nebula . . . . .	33
14 Double Star . . . . .	33
1435 Star Cluster . . . . .	33
Σ (15) Multiple Star . . . . .	33
1453 Star Cluster . . . . .	34
1465 " " " " " " . . . . .	34
1474 " " " " " " . . . . .	34
1483 " " " " " " . . . . .	34
<i>U</i> Variable . . . . .	36
1611 Star Cluster . . . . .	38
Σ 1183 Double Star . . . . .	38
29 Triple Star . . . . .	38
1637 Star Cluster . . . . .	38

**Ophiuchus.**

(Sheet XI.)

ρ Double Star . . . . .	54
λ " " " " " " . . . . .	54
4211 Star Cluster . . . . .	54
4238 " " " " " " . . . . .	55
19 Double Star . . . . .	55
4256 Star Cluster . . . . .	55
Nova of 1848 . . . . .	56
4264 Star Cluster . . . . .	56
4268 " " " " " " . . . . .	56
4269 " " " " " " . . . . .	56
4270 " " " " " " . . . . .	56
36 Double Star . . . . .	56
<i>R</i> Variable . . . . .	56
<i>U</i> " " " " " " . . . . .	56
39 Double Star . . . . .	56
4287 Star Cluster . . . . .	56
4296 Nebula . . . . .	57
4302 " " " " " " . . . . .	57
Σ 2166 Double Star . . . . .	57
Nova of 1604 . . . . .	57
Σ 2173 Double Star . . . . .	57
53 <i>f</i> " " " " " " . . . . .	57
54 " " " " " " . . . . .	57
4315 Star Cluster . . . . .	57
61 Double Star . . . . .	58
4346 Star Cluster . . . . .	58
67 Double Star . . . . .	58
τ Triple Star . . . . .	58
70 Double Star . . . . .	59
73 " " " " " " . . . . .	59
4890 Nebula . . . . .	59
4410 Star Cluster . . . . .	60

**Orion.**  
(Sheet II., III., VIII.)

905 Star Cluster . . . . . 23  
*R* Variable . . . . . 23  
 $\Sigma$  627 Double Star . . . . . 21  
 96 *B* Red Star . . . . . 24  
 1005 Nebula . . . . . 21  
 14 Double Star . . . . . 24  
 $\Sigma$  652 .. . . . 24  
 $\epsilon$  .. . . . 24  
 $\beta$  .. . . . 25  
 $\tau$  Multiple Star . . . . . 25  
*m* Double Star . . . . . 25  
 $\eta$  Triple Star . . . . . 26  
 $\gamma$  Variable . . . . . 26  
 $\psi^2$  Double Star . . . . . 26  
 $\delta$ 1 .. . . . 26  
*A* 32 .. . . . 26  
 $\delta$ 3 .. . . . 26  
 $\delta$  .. . . . 27  
 $\lambda$  Triple Star . . . . . 27  
 $\Sigma$  747 Double Star . . . . . 28  
 1179 Great Nebula . . . . . 28  
 (Sheet XVI.)  
 1184 Star Cluster . . . . . 29  
 $\epsilon$  Triple Star . . . . . 29  
 1185 Nebula . . . . . 29  
 1193 Nebula around  $\epsilon$  . . . . . 29  
 $\sigma$  Multiple Star . . . . . 29  
 1225 Nebula . . . . . 30  
 $\zeta$  Triple Star . . . . . 30  
 1226 Nebula . . . . . 30  
 1227 .. (Sheet XVIII.) 30  
 1267 .. . . . 31  
 52 Double Star . . . . . 31  
 $\Sigma$  816 .. . . . 31  
 1310 Star Cluster . . . . . 31  
 $\alpha$  Variable . . . . . 31  
 1361 Star Cluster (Sheet XV.) . . . . . 31  
 $\Sigma$  855 Double Star . . . . . 31  
 1376 Star Cluster . . . . . 32  
 1383 .. . . . 32

**Pegasus.**  
(Sheet II., VI., XII.)

$\gamma$  Double Star . . . . . 11  
 1 .. . . . 70  
 1670 .. . . . 70  
 3 .. . . . 71  
 $\epsilon$  .. . . . 71  
 $\kappa$  .. . . . 72  
 20 .. . . . 72  
 33 Triple Star . . . . . 72  
 37 Double Star . . . . . 72  
 $\eta$  .. . . . 73  
 1815 Nebula . . . . . 73  
 $\xi$  Double Star . . . . . 73  
 $\beta$  Variable . . . . . 73  
 $\delta$  .. . . . 73  
 5024 Star Cluster . . . . . 74

**Perseus.**  
(Sheet I., II., III., V., XVII.)

385 Nebula . . . . . 15  
 Variable Star in . . . . . 16  
 512 Star Cluster (Sheet XVII.) . . . . . 17  
 521 .. . . . 17  
 584 .. . . . 18  
 Nova Persei . . . . . 19  
 20 Triple Star . . . . . 19  
 $\eta$  Double Star . . . . . 19  
 $\rho$  Variable . . . . . 19  
 $\beta$  .. . . . 19  
 658 Star Cluster . . . . . 19  
 $\Sigma$  569 Double Star . . . . . 20  
*R* Variable . . . . . 20  
 Nova . . . . . 20  
 717 Star Cluster . . . . . 20  
 $\alpha$  Double Star . . . . . 20  
 775 Star Cluster . . . . . 21  
 $\zeta$  Quintuple Star . . . . . 21  
 $\epsilon$  Double Star . . . . . 21  
 809 Star Cluster . . . . . 21  
 $\mu$  Triple Star . . . . . 21  
 820 Star Cluster . . . . . 21  
 831 .. . . . 22  
 $\Sigma$  533 Double Star . . . . . 22  
 $\Sigma$  552 .. . . . 22  
*m* .. . . . 23

**Pisces, The Fish.**  
(Sheet II., VI., VII., XII.)

35 Double Star . . . . . 11  
 51 .. . . . 12  
 55 .. . . . 12  
 65 .. . . . 13  
 66 .. . . . 13  
 $\psi^1$  .. . . . 14  
 77 .. . . . 14  
 $\eta$  .. . . . 14  
 $\phi$  .. . . . 14  
 $\zeta$  .. . . . 14  
 307 Nebula . . . . . 15  
*R* Variable . . . . . 15  
 372 Nebula . . . . . 15  
 $\alpha$  Double Star . . . . . 16

**Piscis austrinus, The Southern Fish.**  
(Sheet XII.)

**Sagitta, The Arrow.**  
(Sheet V., VI., XII.)

$\xi$  Double Star . . . . . 64  
 $\zeta$  Triple Star . . . . . 65  
 1520 Star Cluster . . . . . 65  
 13 Double Star . . . . . 66  
 $\Sigma$  Triple Star . . . . . 66  
 1572 Nebula . . . . . 67

**Sagittarius, The Archer.**  
(Sheet XI., XII.)

$\lambda$  Variable . . . . . 58  
 1355 Nebula (Sheet XV.) . . . . . 58

4459 Star Cluster . . . . . 58  
 4361 .. . . . 58  
 1367 .. . . . 58  
 $\eta$  Variable . . . . . 59  
 1376 Star Cluster . . . . . 59  
 1388 .. . . . 59  
 $\rho$  Quintuple Star . . . . . 59  
 1397 Star Cluster . . . . . 59  
 4491 .. . . . 60  
 4493 Nebula (Sheet XVI.) . . . . . 60  
 4496 Star Cluster . . . . . 60  
 21 Double Star . . . . . 60  
 $\zeta$  Variable . . . . . 60  
 $\mathcal{M}$  25 Star Cluster . . . . . 61  
 4424 .. . . . 61  
 4442 Nebula . . . . . 62  
 Nova 1898 . . . . . 63  
 54 Double Star . . . . . 64  
 1519 Nebula . . . . . 64  
 1543 .. . . . 66

**Scorpio, The Scorpion.**  
(Sheet X., XI.)

$\xi$  Triple Star . . . . . 53  
 $\beta$  .. . . . 53  
 $\epsilon$  Double Star . . . . . 53  
 4173 Star Cluster (Sheet XVIII.) . . . . . 53  
 $\sigma$  Double Star . . . . . 53  
 1183 Nebula . . . . . 54  
 $\alpha$  Antares . . . . . 54  
 1264 Star Cluster . . . . . 56

**Scutum Sobieski, Sobieski's Shield.**  
(Sheet XI.)

4400 Star Cluster . . . . . 60  
 4426 .. . . . 61  
 4429 .. . . . 61  
 4432 .. . . . 61  
*R* Variable . . . . . 61  
 4437 Star Cluster . . . . . 62  
 4441 Nebula . . . . . 62

**Serpens, The Serpent.**  
(Sheet IV., V., X., XI.)

4083 Star Cluster . . . . . 51  
 5 Double Star . . . . . 51  
 $\Sigma$  1931 .. . . . 51  
 $\delta$  Variable . . . . . 51  
 6 Double Star . . . . . 52  
 $\alpha$  .. . . . 52  
 $\beta$  .. . . . 52  
*R* Variable . . . . . 52  
 19 Double Star . . . . . 53  
 $\nu$  .. . . . 57  
 59 *l* .. . . . 59  
 $\Sigma$  .. . . . 59

**Sextans, The Sextant.**  
(Sheet IX.)

9 Double Star . . . . . 44  
 6088 Nebula . . . . . 44

		PAGE	Ursa major, The Great Bear.	Virgo, The Virgin.	PAGE
2038 Nebula	11	41	(Sheet I., II., III., IV.,	(Sheet X.)	
35 Double Star	12	42	V., XII.)		
41 Triple Star	12	42			
<b>Taurus, The Bull.</b>					
(Sheet II., III., VII., VIII.)					
7 Triple Star	20	39	1711 Nebula	2806 Nebula	11
Σ 430 "	20	39	α Double Star	Σ 1627 Double Star	14
768 Nebula	20	39	1750 Nebula	2878 Nebula	15
η Quadruple Star (Sheet XIII.)	20	39	σ <sup>2</sup> Double Star	2930 "	15
30 Double Star	21	39	1765 Nebula	2961 "	15
Σ 453 "	21	40	1781 "	3021 "	15
λ Variable	21	40	1823 "	3035 "	15
Σ 495 Double Star	21	40	23 Double Star	3049 "	15
813 Nebulous Star	21	40	θ "	3075 "	15
47 Triple Star	21	41	1909 Nebula	3097 "	16
4 Variable	22	41	φ Double Star	3105 "	16
φ Double Star	22	41	1949 Nebula	3121 "	16
χ "	22	41	1950 "	R Variable	16
γ Variable	22	41	2158 "	3132 Nebula	16
839 Variable Nebula	22	42	R Variable	Σ 1669 Double Star	16
κ Double Star	22	42	2245 Nebula	γ "	16
Σ 518 "	22	42	Σ 1495 Double Star	3176 Nebula	16
R Variable	22	42	α "	3182 "	16
ζ <sup>1</sup> Double Star	22	42	β "	3227 "	17
80 "	23	42	2318 Nebula	Σ 1682 Double Star	17
α Aldebaran	23	42	2343 "	U Variable	17
88 Double Star	23	43	Σ 1520 Double Star	3278 Nebula	17
σ "	23	43	2360 Nebula	3293 "	17
τ "	23	43	2362 "	ε Double Star	17
F Variable	23	43	ξ Double Star	ζ Triple Star	17
1030 Star Cluster	24	43	ν "	α Double Star	18
Σ 674 Double Star	25	43	57 "	W Variable	18
111 "	25	43	Σ 1561 "	S "	18
118 "	26	44	2600 Nebula	3614 Nebula	19
Σ 730 "	26	44	65 Double Star	3615 "	19
1157 Nebula (Sheet XVI.)	27	44	2635 Nebula	84 Double Star	19
1191 "	29	44	2660 "	τ "	19
1199 Star Cluster	29	44	2680 "	φ "	19
		44	2841 "	3900 Nebula	19
		46	T Variable	3964 "	50
		46	S "		
		47	Σ 1695 Double Star		
		48	ζ "		
		49	η Variable		
<b>Triangulum, The Triangle.</b>					
(Sheet II., VI., XII.)					
352 Nebula	15				
422 "	16				
ε Double Star	16				
6 "	17				
<b>Ursa minor, The Little Bear.</b>					
(Sheet I., II., IV., V., XIII.)					
α Polaris	14				
π <sup>1</sup> Double Star	52				
4321 Nebula	57				
<b>Vulpecula, The Little Fox.</b>					
(Sheet V., VI., XII.)					
Σ 2504 Double Star	64				
6 "	64				
4508 Star Cluster	64				
11 Nova 1670	65				
1532 Nebula	66				
16 Double Star	66				
4559 Star Cluster	66				
Σ 2695 Double Star	67				
4591 Star Cluster	68				
R Variable	69				



# INTRODUCTION.

## 1.

THE starry heaven seems to an observer to be a hollow sphere of which one-half lies above and the other below the horizon. The stars seem to be attached to this hollow sphere, and to make with it a daily revolution around the earth. To fix the position of any of the heavenly bodies upon the celestial vault, certain imaginary lines are made use of. The principal lines employed for this purpose correspond with the parallels of latitude and meridians of longitude upon the sphere of the earth, and give the Right Ascension (longitude) and Declination (latitude) of all heavenly bodies. As the meridians of longitude are reckoned eastwards round the earth from a conventionally fixed meridian (Greenwich), and divide the circumference of the earth into 360°, so the celestial sphere is similarly divided by the meridians of Right Ascension, which start from the first point of Aries, and, reckoned in an eastward direction, divide the celestial equator into 360°. Further, as places on the earth north or south of the terrestrial equator are reckoned by degrees of latitude up to 90° towards either pole, so the Declination of heavenly bodies is reckoned in degrees north or south of the celestial equator to the northern or southern celestial poles, which have each 90° of Declination. Thus, just as one is enabled to determine the position of a spot upon the earth by its latitude and longitude, so one can find on the celestial sphere the place of a heavenly body by its Right Ascension and Declination.

The term Right Ascension is expressed shortly by R.A., and Declination by D, which by the addition of the + sign is further meant to designate northerly Declination, and by the sign - southerly Declination.

The time required for a complete revolution of the celestial sphere is called a Sidereal day. This day begins at the instant in which the first point of Aries passes the meridian of the place of observation. The sidereal day is divided into 24 hours (numbered 1, 2, 3, to 24), each hour into 60 minutes, each minute into 60 seconds.

The sidereal day is 3<sup>m</sup> 55<sup>s</sup>.9 shorter than the mean solar day, and, therefore, the first point of Aries, or any fixed star, passes the meridian daily about four minutes earlier than it did the day previously. The beginning of the sidereal day is not, therefore, fixed to any definite hour of mean time, but during the year runs through all the hours of the civil day. As the sidereal day is about four minutes shorter than the mean solar day, so the hours and minutes of the sidereal day are shorter than the corresponding periods of the civil day, as this table shows—

Hours.				Minutes.					
Sidereal Time = Mean Time.				Sidereal Time = Mean Time.			Sidereal Time = Mean Time.		
h.	h.	m.	s.	m.	m.	s.	m.	m.	s.
1	0	59	50	1	0	59.8	20	19	56.7
2	1	59	40	2	1	59.7	30	29	55.1
3	2	59	31	3	2	59.5	40	39	53.6
4	3	59	21	4	3	59.3	50	49	52.0
5	4	59	11	5	4	59.2	60	59	50.2
6	5	59	1	6	5	59.0			
7	6	58	51	7	6	58.9			
8	7	58	41	8	7	58.7			
9	8	58	31	9	8	58.5			
10	9	58	21	10	9	58.4			
20	19	56	43						
24	23	56	4						

If on any day the first point of Aries, of which the R.A. is 0, passes the meridian of an observer at noon, an hour after noon a point of the heaven of R.A.  $15^\circ$  will be on the meridian, after two hours a point of R.A.  $30^\circ$ , after three hours a point of  $45^\circ$ , etc. The Right Ascension of a star, or its distance from the first point of Aries, instead of being expressed in degrees, can thus be indicated by the number of hours, minutes, and seconds which have elapsed from the time of culmination of the first point of Aries until the time this star passes the meridian, or culminates. Thus, instead of expressing the Right Ascension of the bright star Vega by  $277^\circ 30'$  we may say that it amounts to  $18^h 30^m$ . For, as  $360^\circ$  pass the meridian in 24 hours, in one hour  $15^\circ$  will pass, and in 1 time minute 15 minutes of arc, and in 1 time second, 15 arc seconds. Thus  $277^\circ 30'$  turned into time are equal to  $18^h 30^m$ .

In many star maps Right Ascension is expressed in degrees of an arc only. The practice of astronomers, however, without exception, is to reckon the R.A. in time only. Therefore in the present Atlas the parallels for Right Ascension are given in hours and parts of an hour.

In case it is required to turn time into arc measurement, the following table will readily serve the purpose:—

**Table for Turning Sidereal Time into Degrees.**

Hours.	Degrees.	Minutes.	Degrees.	Minutes.	Degrees.
h	°	m	°	m.	°
1	15	1	0 15	31	7 45
2	30	2	0 30	32	8 0
3	45	3	0 45	33	8 15
4	60	4	1 0	34	8 30
5	75	5	1 15	35	8 45
6	90	6	1 30	36	9 0
7	105	7	1 45	37	9 15
8	120	8	2 0	38	9 30
9	135	9	2 15	39	9 45
10	150	10	2 30	40	10 0
11	165	11	2 45	41	10 15
12	180	12	3 0	42	10 30
13	195	13	3 15	43	10 45
14	210	14	3 30	44	11 0
15	225	15	3 45	45	11 15
16	240	16	4 0	46	11 30
17	255	17	4 15	47	11 45
18	270	18	4 30	48	12 0
19	285	19	4 45	49	12 15
20	300	20	5 0	50	12 30
21	315	21	5 15	51	12 45
22	330	22	5 30	52	13 0
23	345	23	5 45	53	13 15
24	360	24	6 0	54	13 30
		25	6 15	55	13 45
		26	6 30	56	14 0
		27	6 45	57	14 15
		28	7 0	58	14 30
		29	7 15	59	14 45
		30	7 30	60	15 0

The sidereal day begins, as already mentioned, at the instant in which the first point of Aries passes the meridian of the observer. The sidereal time at any moment is therefore equal to the distance, expressed in time, of the first point of Aries westwards from the meridian; in

Table for Turning Degrees into Sidereal Time.

Degrees

	0		1		2		3		4		5		6		7		8		9	
	h.	m.	h.	m.	h.	m.	h.	m.	h.	m.	h.	m.	h.	m.	h.	m.	h.	m.	h.	m.
0	0	0	0	4	0	8	0	12	0	16	0	20	0	24	0	28	0	32	0	36
10	0	40	0	44	0	48	0	52	0	56	1	0	1	4	1	8	1	12	1	16
20	1	20	1	24	1	28	1	32	1	36	1	40	1	44	1	48	1	52	1	56
30	2	0	2	4	2	8	2	12	2	16	2	20	2	24	2	28	2	32	2	36
40	2	40	2	44	2	48	2	52	2	56	3	0	3	4	3	8	3	12	3	16
50	3	20	3	24	3	28	3	32	3	36	3	40	3	44	3	48	3	52	3	56
60	4	0	4	4	4	8	4	12	4	16	4	20	4	24	4	28	4	32	4	36
70	4	40	4	44	4	48	4	52	4	56	5	0	5	4	5	8	5	12	5	16
80	5	20	5	24	5	28	5	32	5	36	5	40	5	44	5	48	5	52	5	56
90	6	0	6	4	6	8	6	12	6	16	6	20	6	24	6	28	6	32	6	36
100	6	40	6	44	6	48	6	52	6	56	7	0	7	4	7	8	7	12	7	16
110	7	20	7	24	7	28	7	32	7	36	7	40	7	44	7	48	7	52	7	56
120	8	0	8	4	8	8	8	12	8	16	8	20	8	24	8	28	8	32	8	36
130	8	40	8	44	8	48	8	52	8	56	9	0	9	4	9	8	9	12	9	16
140	9	20	9	24	9	28	9	32	9	36	9	40	9	44	9	48	9	52	9	56
150	10	0	10	4	10	8	10	12	10	16	10	20	10	24	10	28	10	32	10	36
160	10	40	10	44	10	48	10	52	10	56	11	0	11	4	11	8	11	12	11	16
170	11	20	11	24	11	28	11	32	11	36	11	40	11	44	11	48	11	52	11	56
180	12	0	12	4	12	8	12	12	12	16	12	20	12	24	12	28	12	32	12	36
190	12	40	12	44	12	48	12	52	12	56	13	0	13	4	13	8	13	12	13	16
200	13	20	13	24	13	28	13	32	13	36	13	40	13	44	13	48	13	52	13	56
210	14	0	14	4	14	8	14	12	14	16	14	20	14	24	14	28	14	32	14	36
220	14	40	14	44	14	48	14	52	14	56	15	0	15	4	15	8	15	12	15	16
230	15	20	15	24	15	28	15	32	15	36	15	40	15	44	15	48	15	52	15	56
240	16	0	16	4	16	8	16	12	16	16	16	20	16	24	16	28	16	32	16	36
250	16	40	16	44	16	48	16	52	16	56	17	0	17	4	17	8	17	12	17	16
260	17	20	17	24	17	28	17	32	17	36	17	40	17	44	17	48	17	52	17	56
270	18	0	18	4	18	8	18	12	18	16	18	20	18	24	18	28	18	32	18	36
280	18	40	18	44	18	48	18	52	18	56	19	0	19	4	19	8	19	12	19	16
290	19	20	19	24	19	28	19	32	19	36	19	40	19	44	19	48	19	52	19	56
300	20	0	20	4	20	8	20	12	20	16	20	20	20	24	20	28	20	32	20	36
310	20	40	20	44	20	48	20	52	20	56	21	0	21	4	21	8	21	12	21	16
320	21	20	21	24	21	28	21	32	21	36	21	40	21	44	21	48	21	52	21	56
330	22	0	22	4	22	8	22	12	22	16	22	20	22	24	22	28	22	32	22	36
340	22	40	22	44	22	48	22	52	22	56	23	0	23	4	23	8	23	12	23	16
350	23	20	23	24	23	28	23	32	23	36	23	40	23	44	23	48	23	52	23	56

Minutes

	0'		1'		2'		3'		4'		5'		6'		7'		8'		9'	
	m.	s.	m.	s.	m.	s.	m.	s.	m.	s.	m.	s.	m.	s.	m.	s.	m.	s.	m.	s.
0	0	0	0	4	0	8	0	12	0	16	0	20	0	24	0	28	0	32	0	36
10	0	40	0	44	0	48	0	52	0	56	1	0	1	4	1	8	1	12	1	16
20	1	20	1	24	1	28	1	32	1	36	1	40	1	44	1	48	1	52	1	56
30	2	0	2	4	2	8	2	12	2	16	2	20	2	24	2	28	2	32	2	36
40	2	0	2	44	2	48	2	52	2	56	3	0	3	4	3	8	3	12	3	16
50	3	20	3	24	3	28	3	32	3	36	3	40	3	44	3	48	3	52	3	56

other words, it is equal to the R.A. of the point of the celestial sphere then passing the meridian. Conversely, the Right Ascension of a fixed star expressed in hours and parts of an hour is equal to the sidereal time of its passage through the meridian.

In most cases the observer requires to find out the mean or civil time of the place in which he is at the moment when a certain star, whose Right Ascension is given, is on the Meridian. This can easily be ascertained with the help of the following table, which gives the *approximate* sidereal time of mean noon for every day in the year. If the *exact* sidereal time be required, the Nautical Almanack for the year must be consulted.

### Sidereal Time at the moment of Mean Noon.

Day of the Month.	January.			February.			March.			April.			May.			June.			July.			August.			September.			October.			November.			December.			Date of the Month.
	h.	m.		h.	m.		h.	m.		h.	m.		h.	m.		h.	m.		h.	m.		h.	m.		h.	m.		h.	m.		h.	m.					
1	18	45		20	47		22	38	0	40		2	38	4	41	6	39		8	41	10	43	12	42	14	44	16	42					1				
2	18	49		20	51		22	42	0	44		2	42	4	44	6	43		8	45	10	47	12	45	14	48	16	46					2				
3	18	53		20	55		22	46	0	48		2	46	4	48	6	47		8	49	10	51	12	49	14	52	16	50					3				
4	18	57		20	59		22	50	0	52		2	50	4	52	6	51		8	53	10	55	12	53	14	56	16	54					4				
5	19	1		21	3		22	54	0	56		2	54	4	56	6	55		8	57	10	59	12	57	15	0	16	58					5				
6	19	5		21	7		22	58	1	0		2	58	5	0	6	59		9	1	11	3	13	1	15	3	17	2					6				
7	19	9		21	11		23	1	1	4		3	2	5	4	7	2		9	5	11	7	13	5	15	7	17	6					7				
8	19	13		21	15		23	5	1	8		3	6	5	8	7	6		9	9	11	11	13	9	15	11	17	10					8				
9	19	17		21	19		23	9	1	12		3	10	5	12	7	10		9	13	11	15	13	13	15	15	17	14					9				
10	19	21		21	23		23	13	1	16		3	14	5	16	7	14		9	17	11	19	13	17	15	19	17	18					10				
11	19	25		21	27		23	17	1	19		3	18	5	20	7	18		9	20	11	23	13	21	15	23	17	21					11				
12	19	29		21	31		23	21	1	23		3	22	5	24	7	22		9	24	11	27	13	25	15	27	17	25					12				
13	19	33		21	35		23	25	1	27		3	26	5	28	7	26		9	28	11	31	13	29	15	31	17	29					13				
14	19	36		21	39		23	29	1	31		3	30	5	32	7	30		9	32	11	35	13	33	15	35	17	33					14				
15	19	40		21	43		23	33	1	35		3	34	5	36	7	34		9	36	11	38	13	37	15	39	17	37					15				
16	19	44		21	47		23	37	1	39		3	37	5	40	7	38		9	40	11	42	13	41	15	43	17	41					16				
17	19	48		21	51		23	41	1	43		3	41	5	44	7	42		9	44	11	46	13	45	15	47	17	45					17				
18	19	52		21	54		23	45	1	47		3	45	5	48	7	46		9	48	11	50	13	49	15	51	17	49					18				
19	19	56		21	58		23	49	1	51		3	49	5	52	7	50		9	52	11	54	13	52	15	55	17	53					19				
20	20	0		22	2		23	53	1	55		3	53	5	55	7	54		9	56	11	58	13	56	15	59	17	57					20				
21	20	4		22	6		23	57	1	59		3	57	5	59	7	58		10	0	12	2	14	0	16	3	18	1					21				
22	20	8		22	10		0	1	2	3		4	1	6	3	8	2		10	4	12	6	14	4	16	7	18	5					22				
23	20	12		22	14		0	5	2	7		4	5	6	7	8	6		10	8	12	10	14	8	16	10	18	9					23				
24	20	16		22	18		0	8	2	11		4	9	6	11	8	9		10	12	12	14	14	12	16	14	18	13					24				
25	20	20		22	22		0	12	2	15		4	13	6	15	8	13		10	16	12	18	14	16	16	18	18	17					25				
26	20	24		22	26		0	16	2	19		4	17	6	19	8	17		10	20	12	22	14	20	16	22	18	21					26				
27	20	28		22	30		0	20	2	23		4	21	6	23	8	21		10	24	12	26	14	24	16	26	18	25					27				
28	20	32		22	34		0	24	2	26		4	25	6	27	8	25		10	27	12	30	14	28	16	30	18	28					28				
29	20	36			0	28		2	30	4		4	29	6	31	8	29		10	31	12	34	14	32	16	34	18	32					29				
30	20	40			0	32		2	34	4		4	33	6	35	8	33		10	35	12	38	14	36	16	38	18	36					30				
31	20	43			0	36			4	37			4	37		8	37		10	39			14	40		18	40						31				



For instance, if it be required to find out at what hour of the day on the 15th April, the star Castor, whose Right Ascension is  $7^{\text{h}} 27^{\text{m}}$ , is on the Meridian :

$$\begin{array}{r} \text{Sidereal time of Meridian passage} = \text{Right Ascension} = 7^{\text{h}} 27^{\text{m}} \\ \text{Sidereal time at mean noon on 15th April} \quad \quad \quad = 1^{\text{h}} 35^{\text{m}} \\ \hline \text{Difference} : 5^{\text{h}} 52^{\text{m}} \end{array}$$

It must be borne in mind that the difference is expressed in sidereal hours 24 of which are  $3^{\text{m}} 55.9^{\text{s}}$  shorter than  $24^{\text{h}}$  of mean time. It follows, therefore, that  $5^{\text{h}} 52^{\text{m}}$  sidereal time are  $57^{\text{s}}$ , or speaking roughly,  $1^{\text{m}}$  shorter than the corresponding mean time, and this must be subtracted from the result given above. Castor will therefore be on the Meridian at  $5^{\text{h}} 51^{\text{m}}$ .

### Constellations and the Names of Stars.

Already in the earliest ages the chief fixed stars had received names, and many configurations, fancifully representing natural or mythical objects, were grouped into constellations. In the sixteenth century, when more exact information had been obtained with regard to the southern heavens, constellations were duly marked out there also; nay, even in the last century several new constellations were added to the number, and introduced into astronomical maps. That there was no great resemblance between the constellations and the objects whose names they bore, it is needless to say. The practice which obtained in the old star-atlases, of surrounding the stars composing a constellation with an outline of the person or object which the constellation was supposed to represent, was, therefore, purely fanciful. Until quite recently the greatest uncertainty prevailed, not only with regard to the boundaries, but even as to the number of the constellations. It was finally, however, decided that only those constellations should be recognised which are to be found in Argelander's *Neu Uranometrie*.

The present atlas will therefore be found to contain only those constellations which are given by Argelander, the fantastic figures suggested by their names being omitted.

The following is a list of the constellations visible from our hemisphere, which are to be found in Argelander's *Uranometrie*.

*Andromeda*, Andromeda.  
*Aquarius*, The Water-carrier  
*Aquila*, The Eagle.  
*Argo navis*, The Ship Argo.  
*Aries*, The Ram.  
*Auriga*, the Waggoner.  
*Bootes*, Bootes.  
*Camelopardalis*, The Giraffe.  
*Cancer*, The Crab.  
*Canes venatici*, The Hounds.  
*Canis major*, The Great Dog.  
*Canis minor*, The Little Dog.  
*Capricornus*, The Goat.  
*Cassiopeia*, Cassiopeia.  
*Centaurus*, The Centaur.  
*Cepheus*, Cepheus.

*Cetus*, The Whale.  
*Columba*, The Dove.  
*Coma Berenices*, The Hair of Berenice  
*Corona borealis*, The Northern Crown  
*Corvus*, The Crow.  
*Crater*, The Cup.  
*Cygnus*, The Swan.  
*Delphinus*, The Dolphin.  
*Draco*, The Dragon.  
*Equuleus*, The Foal.  
*Eridanus*, The River Eridanus.  
*Gemini*, The Twins.  
*Hercules*, Hercules.  
*Hydra*, The Hydra.  
*Lacerta*, The Lizard.  
*Leo*, The Lion.

*Leo minor*, The Little Lion.  
*Lepus*, The Hare.  
*Libra*, The Balance.  
*Lupus*, The Wolf.  
*Lynx*, The Lynx.  
*Lyra*, The Lyre.  
*Monoceros*, The Unicorn.  
*Ophiuchus*, Ophiuchus.  
*Orion*, Orion.  
*Pegasus*, Pegasus.  
*Perseus*, Perseus.  
*Pisces*, The Fish.  
*Piscis austrinus*, The Southern Fish.

*Sagitta*, The Arrow.  
*Sagittarius*, The Archer.  
*Scorpio*, The Scorpion.  
*Scutum Sobieski*, The Shield of Sobieski.  
*Serpens*, The Serpent.  
*Sextans*, The Sextant.  
*Taurus*, The Bull.  
*Triangulum*, The Triangle.  
*Ursa major*, The Great Bear.  
*Ursa minor*, The Little Bear.  
*Virgo*, The Virgin.  
*Vulpecula*, The Little Fox.

The stars of the greatest magnitude in each constellation were in former times distinguished by individual names. Thus, the star of the greatest magnitude in the Great Dog is called *Sirius*; the star of the greatest magnitude in the Waggoner is called *Capella*, and so on. At the present day, however, the individual stars in each constellation are indicated by letters of the Greek or Latin alphabet in accordance with a system introduced by Bayer. Thus *Sirius* is described as  $\alpha$  in the Great Dog, *Rigel* as  $\beta$  in Orion. The lesser stars are generally indicated by the numbers assigned to them in a catalogue, in which their positions are given by their Right Ascension and Declination. The catalogue most generally in use for stars which are visible to the naked eye, is that of the second edition of Flamsteed's *Historia Cælestis*, which appeared in 1725. The figures affixed to the majority of the stars in the present work are those of Flamsteed. At the same time, there are many stars faintly visible to the naked eye which have not been catalogued by either Bayer or Flamsteed. These stars are to be found in other catalogues, but they are not specially numbered in this Atlas, except where they occur in Struve's catalogue of double stars. In the case of these stars, the number assigned to each in Struve's catalogue has been inserted, the letter  $\Sigma$  being prefixed.

### Magnitude of the Stars.

The stars are divided into various classes of magnitude according to their apparent brilliancy; thus, the most brilliant stars are said to be of the first magnitude; the least brilliant of those that can be discerned by the naked eye on a clear night are said to be of the sixth magnitude. The arrangement of all the stars visible to the naked eye into these six magnitudes is principally based on the estimates formed by Argelander, Heis, Behrmann, Gould, and Houzeau. Light measurements recently carried out by the aid of photometrical apparatus have proved that the estimate of magnitudes by Argelander's method is fairly trustworthy, and that in general, for the stars visible to the naked eye, each succeeding magnitude after the first indicates the possession of two-fifths of the light of the preceding one.

By the aid of the telescope, and according to its optical powers, stars of still lower magnitude become visible. According to test experiments, a telescope with an objective glass of  $\frac{1}{2}$  inch aperture will show stars of the 7th magnitude; an objective of 1 in., stars of the 9th magnitude; one of 2 in., stars of  $10\frac{1}{2}$  magnitude; one of 3 in., stars of the 11th magnitude; one of 4 in., stars of  $11\frac{1}{2}$  magnitude; of 5 in., those of the 12th magnitude; of 6 in., those of  $12\frac{1}{2}$  magnitude, etc.

It is to be remarked, however, that the estimation of the magnitude of faint stars is very uncertain. Thus, Struve designates the faintest companions of double stars which he could see through the 12-inch refracting telescope of Dorpat as of the 12th magnitude, which according to Argelander's scale would be of the 14th magnitude, and judged by John Herschel would be classified with stars of the 20th magnitude. These discrepancies among observers are not very perceptible in regard to stars up to the 10th magnitude, and they may therefore be disregarded by observers who employ telescopes of only moderate power.

### Number of Fixed Stars.

The most cursory survey of the heavens shows that, generally, the fainter the stars are, the more numerous they appear. From Argelander's observations it appears that in the celestial sphere north of the equator there are—

Stars 1 to 6.5 Magnitude = 4420	Stars 7.6 to 8.0 Magnitude = 11198
.. 6.6 .. 7.0 .. = 3887	.. 8.1 .. 8.5 .. = 22898
.. 7.1 .. 7.5 .. = 6051	.. 8.6 .. 9.0 .. = 52852
Stars 9.1 to 9.5 Magnitude = 213973.	

Beyond the 9.5 magnitude the stars increase in number so much that it is no longer possible to observe them individually or to number them. The desire and the need to place upon our star maps the faintest stars, has in the mean time led to the employment of photography for the purpose, and as a result we are now able to map out the celestial spaces and to give therein stars which approach and even exceed the visibility in our greatest telescopes.

The first experiments in this line attended by successful results were carried out at the Paris Observatory by the brothers Henri. With the aid of an object-glass of 6 in. aperture, expressly constructed for this purpose, they were able to photograph several star clusters, in which stars even of the 12th and 13th magnitude became visible upon the plate. These results led to the construction of a larger instrument of 3.40 millimetres aperture and 3 to 4 metres focus. This was applied to a large ordinary telescope, which served during the time of exposure to keep one and the same point of the heavens continually in the field. The result surpassed all expectation, for stars up to the 16th magnitude were successfully photographed—stars which were so faint that it was impossible to see them by the eye through the same telescope. Here, one might say, in the proper sense of the word, was an astronomy of the invisible; and it must have been with a peculiar joy that the observers saw upon the photographic plate pictures of stars which since the beginning of things had never been revealed to human eye. In order to photograph such faint stars long exposure was necessary, namely one hour and twenty minutes, while stars of the first magnitude gave forth their image in the 200th part of a second. The result of the labours of the brothers Henri led to the passing of a resolution at the Astro-physical Congress in 1887, at Paris, by which it was agreed to undertake a complete photographic survey of the heavens. This enormous undertaking, whose accomplishment was entrusted to the chief Observatories in both the northern and southern hemispheres, is now in an advanced state of progress. By means of photographic telescopes of exactly similar capacities, and by the employment of identical methods, all stars from the 1st to the 13th magnitude were brought under observation, and a catalogue undertaken of stars between the 1st and 11th magnitude the latter being determined by appropriate methods. Each plate embraces 4 square degrees of the celestial sphere, and hence 20626 such plates are needed to complete the survey of the whole heavens. The number of visible stars up to the 11th magnitude amounts to some three millions. If we take in stars up to the 13th magnitude, the number will amount to some thirty millions.

## Variable Stars.

Certain fixed stars exhibit a periodical change in their brightness, which in some cases occurs with great regularity, but in the majority of instances more or less irregularly. The first discovery of this variability was made by David Fabricius in the year 1596, in the case of the star  $\alpha$  in the Whale. This star appeared on the 13th August of that year to be of the 3rd magnitude, whilst in the October following it was no longer visible. That this was a case of variability was first recognised by Holwarda in the year 1636, and the star received, therefore, the name *Mira*, the wonderful. Since this time numerous variable stars have been discovered, the latest list, drawn up by C. Pickering, embracing somewhere about 200. According to the kind and manner of variability, these stars have been divided into five classes.

1. The so-called new stars (*Novæ*) which burst out suddenly and vanish away slowly.
2. Stars of great variability within the space of several months. These stars vary by several magnitudes, being often visible in maximum to the naked eye, whilst in minimum they are frequently not within the scope of powerful telescopes (Mira type).
3. Stars of slight and irregular variability which have no recognisable fixed period.
4. Stars of fairly regular variability whose periods are of a few weeks only (Lyra type).
5. Stars whose variability is confined to a few hours, and which shine during long periods with a constant light (Algol type).

In the lists and upon the star maps the variables are distinguished by the letter R, provided they had not already been indicated by Greek letters before they were found to be variable.

The cause of the variations in light intensity in such cases as those of the Algol class is recognised to be owing to the passage across the disc of the chief star of a dark, or, at least, a less bright planet. The case is similar to that of a partial eclipse of our own sun. We owe to the spectroscope the correct determination of the cause at work in such cases. In the case of variable stars of the Lyra type also, the presence of a relatively dark companion is the recognised cause of variability. The cause which produces the variability of stars belonging to the Mira type is unknown. As to variables whose changes are slight, and of irregular periodicity, we may assume the formation and dissolution of spots on the surface of these bodies to be the cause of the phenomena. As to the so-called new stars (*Novæ*) their sudden outbursts of light are doubtless closely associated with great cosmic revolutions. Perhaps they are to be ascribed to the collisions or near approaches of cosmic masses to one another. In any case, the researches of Professor Seeliger, which led to his regarding each of such outbursts as a world catastrophe, are worthy of consideration.

## Distances of Fixed Stars.

The distances of the fixed stars from our earth are without exception so considerable that up to the present it has been possible only in a few instances to obtain a substantial value for their parallax. From this it appears that even the nearest fixed star is still four billions of miles away, and one must conclude, on the ground of analogy, that the faintest stars which can be seen by the improved telescopes of to-day are many hundreds, or even thousands of billions of miles distant.

## Double Stars.

If one survey the heaven with a telescope one frequently observes twin stars which lie so near to each other that they can be separated only by a glass of a very high power. These are

Double Stars. The brightest of the pair is called the "primary," the other its "companion." Frequently, however, both stars are equally bright. The place of the companion in relation to the primary is expressed by distance ( $d.$ ) and position angle ( $p.$ ).

By distance ( $d.$ ) is meant merely the apparent space which separates the companion from its primary. The appearance of nearness is often owing to the two stars being in almost the same line in regard to the spectator, while their real distance from each other may be immensely great. There are, however, numerous instances in which there is a real propinquity. In these cases the position angle varies in such a manner as to indicate a motion of revolution round a common centre. Such Double Stars are called physically connected in opposition to those which are merely associated visually.

The position angle ( $p.$ ) is the angle which a line drawn from the companion to its primary forms with the latter's circle of Declination. The position angle is calculated from north through east to south and west.

The number of Double Stars is considerable, about 11,000 being known at the present time. There are also triple, quadruple, and quintuple stars, but their number is not large.

The primary and companion are not infrequently of different colours; white and blue, yellow and blue, and green and blue stars being found together. Except in a few cases, however, these colours are only faintly visible, and it requires a certain amount of practice and a powerful telescope to be able to distinguish them.

By the application of very powerful instruments, and especially owing to the labours of Burnham in this connection, it has been determined that a considerable number of the brighter stars have each a close companion much less bright, and the visual angular distance between them is in many cases less than  $0.5''$ . Such Double Stars can be perceived ("separated") only in the most powerful telescopes. Where the visual distance is still smaller (under  $0.1''$ ), our strongest instruments even are at fault. Here again the spectroscope offers its aid, furnishing evidence, by the displacement or periodical doubling of the lines of the spectrum, that the object with which we are dealing is not the single body which it appears to be but, in reality, two stars. These objects are, indeed, "spectroscopic double stars," and it is remarkable that the period of revolution of these dual bodies round their common centre of gravity amounts to only a few days or weeks. We shall, doubtless, discover by the future spectroscopic Double Stars of a longer period of revolution, and thus establish a relationship between the latter and the optical Double Stars whose companions do not complete their period of revolution in less than some years.

### Star Clusters.

Groups of stars collected more or less closely together in a small space are called star clusters. Some few star clusters can be distinguished, though imperfectly, with the naked eye, as, for instance, the Pleiades in Taurus and a cluster in Cancer, but generally they can be clearly seen through the telescope only. Indeed, many of them appear misty and nebulous even in telescopes of ordinary size, a powerful instrument being required to resolve them. Most star clusters seem to be globular in shape, with a strong condensation towards the centre. Frequently the stars in the centre of a cluster are crowded so closely together that they seem a nebulous mass, around which the external stars are collected.

The relative positions of the various stars in these star clusters have been decided by exact measurement in a few cases only; but the recent strides that have been made in the application of photography to astronomical observations lead us to hope that we shall ere long be able to obtain records of their most minute details. We shall thus by the comparison of photographs taken at intervals of sufficient time, arrive at valuable information with regard to the relative motions of the component stars of these clusters.

## Nebulæ.

Nebulæ are among the most remarkable objects to be found in space, but the majority of them cannot be studied in detail except by the aid of the most powerful telescopes. At the present day upwards of 8000 nebulæ are known to astronomers. John Herschel prepared a general catalogue containing 5079 nebulæ and star clusters. For the sake of brevity the nebule are usually distinguished by the numbers assigned to them in Herschel's catalogue, and this course has been followed in the present work, where the numbers are accompanied by the letters G. C. (General Catalogue).

Dreyer drew up later on a still more comprehensive catalogue, each of the objects embraced within it being distinguished by a number. In the following text the numbers from Dreyer's Catalogue are appended in brackets to those taken from John Herschel's List. From the most recent results obtained by the photography of the heavens, the number of these cosmical clouds turns out to be much greater than had been previously supposed. According to Keeler, it is possible to distinguish some 100,000 nebulæ more than had been previously perceived, yet by far the largest number of these new discoveries are only apparent on the photographic plate, and then only after hours of exposure.

While most nebulæ cannot be clearly observed except with a powerful telescope, there are several hundreds, however, which may be studied on a clear night with an ordinary glass, if the weakest power be employed. Viewed in detail, it will be seen that their shapes are various; some round or elliptical, some spindle-shaped, some like planetary discs (*Planetary Nebulæ*), others ring-shaped (*Annular Nebulæ*), others spiral (*Spiral Nebulæ*), while many are quite irregular in outline.

The spectroscope shows that the nebulæ are masses of incandescent gases in which hydrogen plays an important part. Possibly in these glowing masses we have before us the germs of future worlds, or it may be in some cases the disintegrated remains of former solar systems.

## Explanation of the Maps.

The general maps in this Atlas include that portion of the heavens which is visible in Central Europe, and they cover as far as 33° South Declination. The stars are divided by a system of conventional signs into six classes of magnitude according to their apparent brilliancy. The system of numbering adopted is, as a general rule, that of Bayer, by means of the small letters of the Greek and Latin alphabets. Such variable stars as are not given by Bayer, are marked, as is usual, by the capital letters of the Latin alphabet, beginning with **R**, the word **var** being added. A number of especially interesting variable stars, which at their maximum do not attain to the sixth magnitude, are also given. These stars are distinguished by a small circle. Stars catalogued by Struve as double stars, if they have not been noted by Bayer, bear the number they possess in Struve's catalogue, with the letter  $\Sigma$  prefixed; all other numbers attached to stars are those of Flamsteed's catalogue.

Star clusters and nebulæ are distinguished by small circular groups of dots, and the accompanying number is that assigned to each in Herschel's General Catalogue, the numbers in Dreyer's List being added in brackets [ ]. Lastly, the boundary lines of the various constellations are taken from Argelander.

## Description of the more interesting Fixed Stars, Star Clusters, and Nebulæ contained in the Maps of this Atlas.

The following list, in which the various stars, etc., are arranged in order of Right Ascension, gives a fairly complete account of what is scientifically known at the present time of each object upon the Maps. To find in this list any star or nebula contained in the Maps, it is only necessary to take the approximate Right Ascension of the object from the Map, and also its number or letter. These will indicate, without trouble, the object in the descriptive Catalogue. The Right Ascension and Declination here given are those for the year 1900; North Declination is shown by the sign +, South Declination by the sign -.

Right Ascension. 1900.		Declination. 1900.			
h.	m.	°	'		
0	4	+	58	36	$\beta$ <b>Cassiopeiae</b> . This star, 2.5 mag., has at 5' distance a faint companion of 10 mag. Burnham, who observed this star with the 18-inch refractor at Chicago, states that he saw more than a dozen very faint stars nearer to the primary than this companion. The spectrum of B shows feeble but strongly broadened lines, which, according to Vogel, indicate peculiar conditions of pressure and temperature in this star. The magnesium line ( $\lambda$ . 4480) is also manifest.
0	8	+	14	37	$\gamma$ <b>Pegasi</b> , 2.5 mag., with two faint companions, 11 and 11.5 mag. respectively. The primary is red in colour, and probably to a slight extent variable.
0	10	+	8	16	$\delta$ <b>Piscium</b> . A double star, primary 6 mag., companion 7.5 mag., at 11.5" distance. Position angle, 150°. No change in the position of the companion has been observed.
0	18	+	55	14	$\epsilon$ <b>Cassiopeiae</b> . A red-coloured star, found to be variable by Krüger in 1870. It varies from about 7.5 mag. at maximum to 11 at minimum. The period of variation is about 445 days.
0	19	+	38	1	$\zeta$ <b>Andromedae</b> . A variable star with a period of about 411 days, noted as such by Argelander in 1858. It is of a rich orange colour. Its magnitude at maximum is 5.6, and at minimum it is invisible, even with a most powerful telescope.
0	19	-	9	53	$\eta$ <b>Ceti</b> . This star was found to be variable by Borelly in 1872. It varies from 8 mag. to 11 mag. Its supposed period of 320 days is very uncertain.
0	19	+	63	35	<b>Place of the New Star in Cassiopeia</b> , which Tycho observed from 11 Nov., 1572, till March, 1574, as a star of 1 mag. D'Arrest has made a list of all the stars in the neighbourhood of Nova, with the aid of the large refractor at Copenhagen, and states that any star not yet set down in his Chart, which may appear within a radius of 10' from the place of Nova, may be considered as either new or variable. D'Arrest's Chart will be found at Sheet XVI. of this Atlas. The most brilliant star in this Chart is 8.9 mag., the faintest 16 mag. A photographic survey of this region made by J. Roberts in 1889 gives no indication of Nova.
0	24	+	59	40	63 (129), <b>Star Cluster in Cassiopeia</b> . The stars composing this cluster, which was discovered by W. Herschel 16 Dec., 1788, are coarsely

Right Ascension, 1900.	Declination, 1900.	
h. m.	°	
0 26	+ 60 58	scattered. The cluster is nearly round in shape, and is from 15' to 20' in diameter. Near the centre may be seen a star of 8.5 mag., and one or two others of 9 mag.; the rest are fainter, some of them being scarcely visible. 68 (136), <b>Star Cluster in Cassiopeia</b> , is about 1' in diameter, and rich in very minute stars. Discovered by Herschel 26 Nov., 1788, and described by him as but little removed from a resolvable nebula. The stars are densely massed together towards the centre of this cluster, which is globular in shape.
0 27	+ 6 25	51, <b>Piscium</b> , ( $\Sigma$ 36) 5 mag., has a companion of 9 mag. at 27" distance. No change has been observed in the position of this latter since the first accurate measurement.
0 35	+ 20 54	55, <b>Piscium</b> , ( $\Sigma$ 46). A double star. The primary is 5 mag., and yellow in colour. The companion at 6" distance is 8 mag. and of a deep blue colour. Two very beautiful stars.
0 35	+ 55 59	$\alpha$ <b>Cassiopeiae</b> , ( $\Sigma$ 45). A reddish-coloured star, 2.2 mag., found to be slightly variable by Birt and John Herschel in 1831. It has a companion 9 mag. at 62" distance.
0 37	+ 40 43	116 (224), <b>The Great Nebula in Andromeda</b> . In fine weather, if there be no moonlight, this nebula can be clearly seen with an opera-glass. It is mentioned as early as the tenth century by the Persian astronomer Sufi. In the West it seems to have been first noticed by Simon Marius, 15 Dec., 1612. On examining it with the naked eye it appeared to him to be merely a small cloud, and on applying the telescope he could discover no evidence that it was of a stellar nature; it seemed nothing more than a patch of whitish light of greater brilliancy at the centre and fainter at the edges. Marius compared it to a light seen from a great distance through some semi-transparent medium. Halley described the nebula as triangular, but Messier contends that it is formed in the shape of two luminous pyramids applied on opposite sides of a common base, the diagonal passing from apex to apex pointing from N.W. to S.E. The distance between the apices is two-thirds of a degree, and the length of the common base one quarter of a degree. Messier saw no star in the nebula, but noticed an increase of brilliancy towards the centre. Later on F. W. Herschel examined the nebula through his great telescope. The luminous central portion he, too, found to be of a nebulous character, but with indications of its being resolvable into separate stars. The middle, or the so-called nucleus of the nebula, has not a starry appearance, but viewed through a very powerful telescope it has a certain flaky look, which confirms Herschel's opinion of its stellar character. Finally, an examination made in 1848, with the aid of the great refractor at Cambridge (U.S.A.), proved the existence of upwards of 1500 minute stars within the nebula, while the nebulous character of the whole was still apparent. Two thin, dark parallel streaks, somewhat like two cracks, were found to run through the mass of stars, and have since been noticed by other observers. In the spectroscope this nebula gives clearly a continuous spectrum, thus proving that it is not a mass of incandescent gas, but rather a highly condensed star cluster. With a powerful glass several faint stars may be seen scattered up and



Right Ascension, 1900.	Declination, 1900.
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h.	m.
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down over the nebula, one of them being of 10.5 mag. About the end of August, 1885, a star of 6.5 mag. suddenly appeared near the centre of the nebula which gave a continuous spectrum containing, probably, a few bright lines. By the middle of the following September it had dwindled down to 8.5 mag., and in the summer of 1886 had disappeared entirely, even the great refractor at Washington failing to discover it. This new star was not, probably, a condensation of the central portion of the nebula, but seems on the contrary to have had no relation to it. Probably it has always been in the place where it appeared, and is one of the countless faint stars observed there by Bond. The sudden increase in brilliancy which took place towards the end of August, 1885, was probably not owing to a great eruption of incandescent gas, but rather to other circumstances. Of the various possible theories, that which attributes the phenomenon to the conversion of cosmic motion into heat and light seems the most probable. Roberts' photograph, taken in December, 1888 (four hours' exposure), gives clearer details than any previously attained. From these it appears that this nebula is in reality a flat spiral, placed obliquely to the line of sight, with a globular mass in its centre. Later photographic surveys have confirmed this view.

0	37	+ 40	19
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117 (221), **Companion of the great Nebula in Andromeda.** Viewed through a telescope of low power, this has the appearance of a nebulous star. In reality it is a star cluster, but a very powerful instrument is required to distinguish the separate stars.

0	38	+ 61	14
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120 (225), **Star Cluster in Cassiopeia.** Discovered by Caroline Herschel. The stars are scattered somewhat coarsely over a space of from 15' to 20' in diameter, and range from 9 to 10 mag.

0	43	- 25	50
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138 (253), **Nebula in Cetus** was discovered by Caroline Herschel, Sept. 23, 1783; it is long, narrow, and bright, and is preceded by a star of 9 mag.

0	43	+ 57	18
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$\eta$  **Cassiopeiae.** A yellowish star, 4 mag., with a purple-coloured companion of 7.5 mag., discovered by Herschel, 17 Aug., 1779. The distance of the companion in 1882 was 5.2"; the position angle 165.7°; the time of revolution round its primary as calculated by Dunér is 176 years: the parallax, according to Clausen, is 0.371", indicating a distance from the earth of eleven billion miles.

0	45	+ 27	10
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65, **Piscium.** A double star, discovered by Herschel in 1783. Both stars are of 6 mag., and their relative position does not seem to vary. Distance 4".

0	49	+ 48	38
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66, **Piscium.** Recognised as a double star at Pulkowa, the primary being 6 mag., the companion 7 mag. Muller, in 1843, found the distance to be 0.6". Dembowski, in 1885, could only perceive a single star of elongated form. Burnham, in 1891, found the companion's distance to be 0.4". The velocity of revolution of the companion is very high.

0	51	+ 60	10
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$\gamma$  **Cassiopeiae.** This star, 3 mag., has a companion of 9 mag., at distance 432", position angle 327°. There are nearly a dozen very minute stars nearer to the primary, but they can only be seen with a telescope of the highest power. In the spectrum of the primary the bright hydrogen

Right Ascension, 1900.		Declination, 1900.		
h.	m.			
				line appears as a projecting knot of light, from which Prof. Scheiner concludes that this star has a very extensive atmosphere of glowing hydrogen, and a relatively small nucleus.
0	51	+ 37	58	$\mu$ <b>Andromedae</b> . A double star of 4 mag. and 9.5 mag., first recognised as such by John Herschel. The distance of the companion is 30".
0	53	+ 81	20	$U$ <b>Cephei</b> . A variable star of the Algol type, discovered by Ceraski in 1880. The star is generally 7.1 mag., but diminishes to 9 mag. in periods of 2.5 days. With a powerful telescope, two faint companions, of 11.5 and 13 mags. respectively, may be seen.
0	59	+ 0	50	26, <b>Ceti</b> . A double star. Primary 6.5 mag., companion 9 mag.; distance 16"; position angle 252°. The position of the companion does not seem to vary.
1	0	+ 20	56	$\psi^1$ <b>Piscium</b> . A double star, consisting of two white-coloured stars of 5 mag.; distance 30". They can be easily "divided" with the help of a pocket telescope. No change has been observed in their relative positions during the last 130 years.
1	1	+ 4	22	77, <b>Piscium</b> . A beautiful double star; primary 6 mag., companion 6.8 mag.; distance 33". No change has been observed in their position.
1	4	- 10	42	$\eta$ <b>Ceti</b> . A yellow star of 3.5 mag., with a companion of 9.5 mag. d. = 225", p. = 305°.
1	6	+ 30	53	$g$ <b>Piscium</b> . Recognised as a double star at Pulkowa. Primary 5 mag., companion 10 mag.; distance 2.5".
1	8	+ 24	3	$\phi$ <b>Piscium</b> , 5 mag., with a faint companion 10 mag. at 8" distance; position angle 228°. Piazzì calls it a double star, but it is quite evident that his telescope would not have enabled him to see it had it been as faint then as it is at the present day.
1	9	+ 7	3	$\zeta$ <b>Piscium</b> . A beautiful double star, easy to observe, the primary and companion being 4.5 mag. and 6 mag. respectively. The distance and position angle have not undergone any essential alteration since Struve measured them in 1821, the former being 24", the latter 64°. Burnham found in 1889 that the companion itself is double, consisting of stars of 5.3 and 11 mags. respectively; d. = 0.9".
1	12	+ 72	5	$S$ <b>Cassiopeiae</b> . A variable star of long period, red, discovered by Argelander in 1861. At maximum it is 6.7 mag., though it is often less than 8 mag.; at minimum it is under 13 mag., or it becomes quite invisible. The period is 610 days.
1	13	+ 57	48	256 (457), <b>Star Cluster in Cassiopeia</b> . A large cluster, rich in stars and nearly round in shape. The stars range from 7 to 10 mag. Discovered by Herschel, 18 Sept., 1787. There is a double star in the cluster of 8 and 9 mags.
1	15	- 1	2	42, <b>Ceti</b> . A double star, 6 and 7 mag. Distance only 1.4", p. = 339°.
1	22	+ 88	46	$\alpha$ <b>Ursae Minoris</b> , the <b>Pole Star</b> , 2 mag.; gives a yellowish light. It has a companion of 9 mag., distance 18.5", which was discovered by Herschel, 17 Aug., 1779. According to Peters' calculation, its parallax is 0.08", indicating a distance from the earth of 40 billions of miles, but this result is very untrustworthy. Campbell discovered at the Lick Observatory that $\alpha$ itself is a spectroscopic double star. The

	Right Ascension, 1900.	Declination, 1900.	
			companion, invisible in the telescope, has a period of revolution of only 4 days.
1	19	+ 67 36	<p>♃ <b>Cassiopeiae</b>. A triple star. Herschel saw only the primary 4.4 mag. and a companion 9 mag., at distance 27". Struve, in 1831, was the first to divide this latter into two separate stars of 8.9 and 9.5 mags. respectively, distance 3". Burnham saw also a companion of 13 mag. at d. = 2.9", p. = 42".</p>
1	19	+ 9 1	307 (524), <b>Nebula in Pisces</b> . A bright and fairly large nebula, with an increase of brilliancy towards the centre; 4 stars near to it.
1	22	+ 44 53	ω, a star of 5.3 mag., with two companions of 11.5 and 10.5 mags. respectively, the latter, as Burnham discovered, being itself a close double. Even powerful telescopes find the companion too difficult to detect.
1	26	+ 2 22	<p>♄ <b>Piscium</b>. A variable star of yellowish colour with a long period, discovered by Hind in 1851. At maximum it is from 7½ to 8½ mag., at minimum it is as low as 12½ mag.; it gains more quickly in brilliancy than it loses, and the period is 344 days.</p>
1	27	+ 60 11	341 (581), <b>Star Cluster in Cassiopeia</b> . This is not a very large cluster, but it contains several stars of 6 to 9 mag., among others a red-coloured star of 8 mag., and a double star, primary 6 mag., companion 10 mag., distance 14".
1	26	- 7 23	342 (584), <b>Nebula in Cetus</b> . Faint and rather small, much brighter towards the centre. Discovered by Herschel, 10 Sept., 1785.
1	28	+ 30 9	352 (598), <b>Nebula in Triangulum</b> . Discovered by Messier; very large and faint, but easy to observe in consequence of its extent. With a seven-foot telescope Herschel saw it dimly, and best with a low power. With a ten-foot reflector, the most brilliant part was resolved into separate stars, and when a still stronger instrument was employed, almost the whole nebula was resolved into stars, which seemed to Herschel nothing more than the smallest imaginable points. This nebula is nearly 30' in extent. Lord Rosse observed in it nodes of light, and the well-known spiral arrangement shown by his telescope in several similar objects.
1	30	+ 29 55	361 (613), <b>Nebula in Cetus</b> . Discovered by Herschel 9 Dec., 1798. This nebula is fairly brilliant, with a brighter nucleus, and is 6' long by 1½' broad.
1	31	+ 15 16	372 (628), <b>Nebula in Pisces</b> . Discovered by Méchain in Sept., 1780, and described by him as a starless nebula of fairly large dimensions, but very faint and difficult to observe. Messier confirmed this view. Sir John Herschel, on the other hand, describes it as a globular star cluster, capable of being clearly resolved into separate stars, whose brilliancy increases gradually at first, and then suddenly at the centre. Lord Rosse, with the help of his great telescope, detected a spiral arrangement of the stars.
			Vogel saw it in October, 1867, with the 8-inch refractor at Leipsic, as a faint, globular star cluster, 3' in diameter, the stars being a little more densely collected towards the centre.
1	36	+ 51 4	385 (650), <b>Nebula in Perseus</b> . The preceding of two nebulae, which stand at a distance of 2' from one another. Méchain saw it first, 5 Sept., 1780 and described it as a small, faint, starless nebula. Messier believed

h.	m.	Right Ascension. 1900.	Declination. 1900.	
			°	it to consist of small stars, intermingled with nebulae; this, however, was a mistake. The nebula is fairly brilliant. Rosse recognised this object as a spiral nebula.
1	39	+ 60	45	392 (663), <b>Star Cluster in Cassiopeia</b> . A beautiful object, 15' in diameter, rich in stars, ranging from brilliant to faint minute points; a double star, primary 9 mag., companion 10 mag., distance 8", is to be seen in the cluster; also a red-coloured star 8 mag. in the southern portion.
1	45	- 11	10	$\chi$ <b>Ceti</b> , 5 mag.; at distance 3' stands a star of 7 mag.
1	47	+ 35	37	422 (700), <b>Nebula in Triangulum</b> . In this Herschel, 4 Sept., 1784, discovered four separate starry nebulae, three standing in a line, the fourth at right angles to them; that at right angles is much the largest. D'Arrest observed these nebulae afterwards. According to Lord Rosse, there are three others near them, but Dreyer thinks these to be identical with those observed by Herschel.
1	48	+ 18	48	$\gamma$ <b>Arietis</b> . A beautiful double star, primary 4.2 mag., companion 4.4 mag., observed by Hooke in 1644, and described by him as remarkable in the highest degree. It can be divided by the help of a small telescope: distance 8", position angle 179°. There is besides, at distance 224", position angle 84°, a faint star, first seen by J. Herschel and South in 1823. Burnham, 1878, discovered that this star is also double (8.9 and 13.2 mags.), but its division is extremely difficult. Between it and $\gamma$ he saw another very faint star.
1	52	+ 37	10	457 (752), <b>Star Cluster in Andromeda</b> , 30' in diameter, containing numerous brilliant, coarsely scattered stars, visible to a keen eye without the aid of a telescope as a nebulous star. Herschel first observed it 21 Sept., 1786.
1	52	+ 23	7	$\lambda$ <b>Arietis</b> . A double star, discovered by Chr. Mayer, primary 5 mag., companion 8 mag., distance 38", can be divided by a good pocket telescope.
1	54	+ 20	32	$\Sigma$ 196, <b>Arietis</b> . A triple star, primary 8 mag., companions 10 and 11 mags. respectively. The brightest companion is at distance 3' 4", position angle 0.8°.
1	55	+ 56	15	<b>Variable Star in Perseus</b> . Mrs. Fleming found upon star photographs taken at Cambridge in 1887, a star of the 9 mag. in this place giving bright hydrogen lines in its spectrum. This star appeared weaker in subsequent photographs, and vanished altogether before the end of 1887. Even in photographs of the region taken in 1885 and 1886, there is no record of this star. It is a matter of uncertainty whether this is the case of a Nova, or of a variable with a very long period.
1	57	+ 2	17	$\alpha$ <b>Pisium</b> . A beautiful double star, primary (which is green in colour) 2.8 mag., companion (which is blue in colour) 3.9 mag., distance 3". The movement of the companion is very slow.
1	57	+ 32	49	$\epsilon$ <b>Trianguli</b> . This star, 5.5 mag., has an exceedingly faint companion, distance 4", position angle 120°. It requires a very powerful instrument to distinguish this companion.
1	58	+ 41	51	$\gamma$ <b>Andromedae</b> . A gold-coloured star, 3 mag., with a blue companion, 6 mag. Distance 10". The colour of both stars is very intense, and they are easily recognised as a double star. In 1842, however, Struve discovered

h	m	Right Ascension 1900.	Declination. 1900.
2	4	+ 25	28
2	7	+ 29	50
2	10	+ 24	36
2	14	+ 56	40
2	14	- 3	26
2	16	+ 41	54
2	21	+ 66	59

that the companion is itself a double star, consisting of two separate stars of 6.7 mag. and 8.5 mag. respectively, distance only 0.5". In the year 1890 Burnham himself could not detect the companion with the 36-inch Lick refractor. Since then the distance has again become greater. The period of revolution is some 55 years.

14, **Arietis**. A triple star; the primary 5.6 mag., has at distance 93", position angle 36.4°, a companion 8.9 mag., and a second 7 mag., at distance 106", position angle 278.5°. Herschel had measured the distance of the nearer companion in 1783.

6, **Trianguli**. A double star, primary (which is yellow) 5 mag., companion (which is blue) 6 mag., distance 3.8". Discovered by Herschel in 1781.

**R Arietis**. A variable orange-coloured star, discovered at Bonn in 1857, and since then frequently observed. The period is 186.6 days. At maximum the star is 7.5 to 9.0 mag.; at minimum 12 mag. and under. When approaching its maximum the increase in brilliancy is often for weeks together very slow.

512, 521 (869, 884), **Two large Star Clusters in Perseus**, being one of the most magnificent objects of its kind in the heavens. The larger of the two ( $\chi$ ) is 30' in diameter, and consists of a large number of stars ranging in magnitude from 6.5 to 13 and 14. Vogel and Lamont have measured this cluster with the micrometer. The southern cluster ( $h$ ) is smaller, being 15' in diameter and less rich. The stars appear condensed towards the centre. Photographs have been taken of both clusters by the brothers Henri at Paris, Dr. Lohse at Potsdam, and others.

$\alpha$  **Ceti (Mira)**. A variable star with long period, and the first whose variability was detected. D. Fabricius observed it early on the morning of 12 August, 1596, as somewhat brighter than  $\alpha$  Arietis. In October it had disappeared. He saw it again in February and March, 1609; then Holwarda observed it in 1638, and recognised its periodical variability. According to Argelander's calculations the period is 331½ days, but it is very irregular, and the difference of period is sometimes as much as 25 days. Its magnitude at maximum also varies greatly, being sometimes as much as 2 and often not more than 5. At minimum it is 9 mag., being the same magnitude as that of a companion at distance 2', position angle 85°. The star is of a deep red colour, and gives an interesting spectrum: four bright hydrogen lines are visible in it, also numerous dark carbon lines, and in the red end dark bands. Campbell discovered irregular shifting of the bright lines, the cause of which remains yet to be determined.

527 (891), **Nebula in Andromeda**. Fairly brilliant, 15' long by 3' broad, with a dark cleft in the middle. Discovered by Miss Herschel in August, 1783. According to John Herschel, it is a vast, flat, nebular ring, which is seen obliquely by us.

$\epsilon$  **Cassiopeiae**. A triple star, discovered by W. Herschel. The primary 4.2 mag. has one companion 7.1 mag., distance 2.2", and a second companion 8.1 mag., distance 7.4". The nearer companion is not easily distinguished.

Right Ascension. 1900.		Declination. 1900.		
h.	m.	°	'	
2	21	-	0 38	<b>R Ceti.</b> A variable star, first recognised as such by Argelander, 1866. At maximum it reaches sometimes 7·5 mag., at minimum, 13 mag. Period, 167 days.
2	23	-	1 36	544, <b>Planetary Nebula in Cetus.</b> Rather faint, with a diameter of from 3' to 4'; there are several stars round it. Discovered by W. Herschel 6 January, 1785.
2	31	+	5 10	<b>ν Ceti.</b> A double star, 5 mag., with a faint companion of 9·6 mag. Distance 7·7"; position angle, 83°. No change in the position of the companion has been detected.
2	31	+	24 13	30, <b>Arietis.</b> A beautiful double star, not difficult to observe. Its primary is 6 mag.; companion, 7 mag.; distance, 38·6". Both stars are white in colour. No change in position has been noticed since the time of Bradley.
2	34	+	38 38	575 (1023), <b>Nebula in Andromeda.</b> Faint, 5' in length, spindle-shaped, and surrounded by several faint stars.
2	35	+	26 39	33, <b>Arietis.</b> A double star, first seen by Herschel 27 September, 1779. Primary, 5·8 mag.; companion, 8·7 mag.; distance, 28·5"; position angle, 359·4°. No change in position has been observed.
2	37	+	48 48	ζ <b>Persei.</b> A star of 4·2 mag., with a companion of 10 mag., at a distance 17·9", p. = 298°. A second companion 9·5 mag., at distance 69·2", p. = 218°.
2	36	+	42 21	584 (1039), <b>Star Cluster in Perseus,</b> having a diameter of 15'; discovered by Messier. The stars range from 9 to 11 mag., and are coarsely distributed; with a small telescope upwards of 100 stars can be distinguished.
2	38	-	0 26	600 (1068), <b>Nebula in Cetus.</b> First discovered by Méchain in 1780. It is small, fairly brilliant, and is preceded by one star, and followed by two others. According to Lord Rosse, the nebula shows spiral arrangement.
2	38	+	2 49	γ <b>Ceti.</b> A star of yellow colour, 3·5 mag., with a companion 7 mag.; distance 3"; position angle, 291°.
2	41	-	8 0	604 (1084), <b>Nebula in Cetus.</b> Faint, oval in shape, with a slight increase in brilliancy towards the centre; apparently a star cluster situated at an immeasurable distance.
2	43	+	55 29	η <b>Persei,</b> 4 mag., with a companion (of blueish colour), 8 mag.; distance, 28". There are also several very faint stars near it.
2	43	+	17 6	τ <b>Arietis.</b> A variable star, discovered by Auwers 1870. At maximum, 7·9 to 8·6 mag.; at minimum, 9·3 to 9·7 mag. Period, 313 days. Of a reddish colour.
2	44	+	17 3	π <b>Arietis.</b> Triple; magnitudes, 5, 8, and 10; recognised as triple by Herschel in 1779. The nearest companion is at a distance 3·3"; position angle, 121°. The faint outer companion at distance 25"; position angle, 110°.
2	44	+	26 51	41, <b>Arietis.</b> The primary is 4 mag. Herschel saw a faint companion in 1779 at a distance of 126" (127° position angle), then in 1782 a second at distance 39", position angle, 189°. Finally, Struve, at Pulkowa, discovered yet another very faint companion (11 mag.) at distance 16". The distance of this latter, as observed by Burnham in 1880, was 21", position angle, 266°.

Right Ascension, 1900.	Declination, 1900.
2 47	+ 37 56
2 51	+ 20 56
2 58	- 8 5
2 59	+ 38 27
3 0	+ 24 52
3 2	+ 40 34
3 8	- 1 34
3 8	+ 46 53
3 8	- 29 24

20, **Persei**. A triple: A 6, B 7, C 9, mag. 14. It was first seen by Burnham in 1899 only 0.1" from A. Its period of revolution is only 21 years. C is at distance 14" from A, position angle 238°.

$\epsilon$  **Arietis**. A double star, primary, 4.5 mag., companion 6 mag.,  $p = 81$ , distance 1.5". As conjectured by Struve, the primary probably varies from 4.5 mag. to 6.5 mag., and the companion also seemed to him variable. Engelmann supports this theory.

$\zeta^2$  **Eridani**, 6 mag., with a companion of 10 mag., distance = 25.  $p = 81^\circ$ ; discovered by Burnham.

$\rho$  **Persei**. This orange-coloured star was first recognised as variable in 1854, by J. Schmidt. The period is seemingly quite irregular, and the brightness at maximum varies considerably.

52, **Arietis**. Triple, but cannot be clearly divided except by a very powerful telescope. The primary, 5.5 mag., has one companion at distance 0.6"; the outer companion, which is very faint (11 mag.), is at distance 5".

$\beta$  **Persei (Algol)**. One of the most interesting variable stars. The variation was discovered as far back as 1767 or 1769, by Montanari, but Goodricke, in 1782, was the first to recognise its true nature. According to his account, the star remains invariable for  $2\frac{1}{2}$  days, and then decreases in  $4\frac{1}{2}$  hours to 3.7 mag., and during the next  $4\frac{1}{2}$  hours it increases to 2.2 mag. The period is 2 days 20h. 48m. 55.4s. This is not constant, there being a difference of a few seconds in the course of the years. In the winter of 1889-90 H. C. Vogel took frequent photographs of the spectrum of Algol at moments when the hydrogen lines were visible. From these it appeared that the lines in the Algol spectrum, observed before the star had reached its least brilliancy, showed a shifting towards the red, corresponding to a recession of the body from the earth at the rate of some 24 miles a second. When the star, on the other hand, began to increase in brightness, a shifting of the lines towards the violet was observed, corresponding with an approach towards the earth of 28 miles per second. Vogel hence came to the conclusion that Algol and a dark companion revolved around their common centre of gravity in an almost circular orbit, and that the light of the principal was thus periodically obscured to us by the companion. From measurements of the motion, and from the period of variability, Vogel deduced for Algol a diameter of 1,062,500 miles, and for its companion a diameter of 837,500 miles, the distance of their common centre from each being 3,250,000 miles. Both stars are probably surrounded by extensive atmospheres, and their united mass is some two-thirds of that of our own sun.

94, **Ceti**, 5.5 mag., has a very faint companion at  $d. = 5.7''$ ,  $p. = 251^\circ$ , which it needs an extremely powerful telescope to distinguish.

658 (1245), **Star Cluster in Perseus**. A beautiful cluster 8' in diameter, very rich in stars of 10 mag. and under. Discovered by W. Herschel, 27 December, 1786.

12, **Eridani**. A star of 3.5 mag., with a companion 7.5 mag., distance 2.4", position angle  $316^\circ$ .

Right Ascension, 1900.		Declination, 1900.		
h.	m.	°	'	
3	11	+ 40	7	$\Sigma$ 369, <b>Double Star in Perseus.</b> The primary, 6.5 mag., is of a yellowish-white colour; the companion, 8 mag., is blueish-white. The distance, 3.5", seems to be increasing, but very gradually.
3	18	- 15	45	692 (1309), <b>Nebula in Eridanus.</b> Rather faint, large, irregularly round in shape, gradually increasing in brilliancy towards the centre. A star, 8 mag., precedes the nebula.
3	21	+ 59	36	$\Sigma$ 385, <b>Camelopardalis.</b> The primary, 5 mag., is yellow in colour, the companion, 9 mag., distance 2.4", position angle, 161°, is white.
3	22	+ 55	6	$\Sigma$ 390, <b>Camelopardalis.</b> Primary, 5 mag., greenish-white in colour, with a faint companion 9.9 mag., distance 15", position angle, 160°.
3	22	- 21	41	709 (1332), <b>Nebula in Eridanus.</b> Discovered by W. Herschel; fairly bright, elongated, but small, with a nucleus, followed southwards by a small and very faint nebula. The spectrum is continuous, and the object is therefore really a star-cluster.
3	24	+ 35	20	<b>R Persei.</b> A variable star. At maximum it sometimes reaches 8 mag., and at minimum becomes frequently less than 13 mag. Period, 210 days. According to Schoenfeld, it remains at 12 mag. and under for two months.
3	24	+ 43	34	<b>Nova Persei.</b> Discovered by Dr. Anderson, of Edinburgh, on February 21, 1901. The star was then of 2.5 mag., and shone with a blueish-white light. On February 23 it was brighter than Capella. The spectrum is of the solar type, containing, however, some bright lines.
3	25	+ 36	59	717 (1342), <b>Star Cluster in Perseus.</b> Large (15' in diameter), contains about 60 stars coarsely scattered. Discovered by Herschel, 28 Dec., 1799.
3	26	+ 58	26	$\Sigma$ 396, <b>Camelopardalis.</b> A star 6.5 mag., with a companion, 8 mag., d. = 20.3", p. = 242°.
3	29	+ 24	7	7, <b>Tauri,</b> 6.5 mag., with a companion 10 mag., distance 22". The star is thus described by W. Herschel, South, and John Herschel. But Struve, with the Dorpat refractor, divided the primary into two stars of almost equal brilliancy, at d. = 0.6". Hall found in 1889, d. = 0.2", p. = 212°.
3	22	+ 0	17	$\Sigma$ 422, <b>Eridani.</b> A double star, primary 6 mag., companion 8 mag., distance 6". The primary is yellow, the companion blueish.
3	35	+ 4	48	$\Sigma$ 430, <b>Tauri.</b> Triple, 6.5, 9, and 9.5 mags. The first companion is at distance 26", position angle, 55°; the second at distance 38", position angle, 301°. The primary is yellowish.
3	36	+ 33	39	<b><math>\rho</math> Persei.</b> A star, 4.5 mag., with a faint companion 9.5 mag.; distance 20", position angle, 237°.
3	40	+ 23	28	768 (1435), <b>Nebula in the Pleiades.</b> Discovered by Tempel, 19 October, 1859. An extremely faint nebula, situated near the star Merope. The brothers Henri have discovered, by the aid of photography, another very faint nebula which seems to proceed from the star Maia, but this can only be seen with a most powerful telescope. (Cf. Sheet XIII.) Barnard and Wolf have since shown, from an examination of photographs, that the Pleiades are surrounded by fine nebulous masses stretching out to a considerable distance.
3	42	+ 23	48	<b><math>\eta</math> in the Pleiades.</b> Quadruple, and a very beautiful object even as seen with a small telescope. The primary, 3.5 mag., has one companion 6.5 mag. at distance 118", position angle, 289°; a second, 7 mag., distance 116", position angle, 344°. Lastly, there is a small star, 9 mag., at



Right Ascension, 1900.		Declination, 1900.		
h.	m.	°	'	
				distance 115" from the companion of 6.5 mag., position angle, 303°; $\eta$ i also known by the name of Alcyone. (See Sheet XIII.)
3	42	+ 52	21	775 (1444), <b>Star Cluster in Perseus</b> . Small, consisting of about 30 stars, ranging in magnitude from 12 to 14, besides one star of 10 mag. The whole is from 2' to 3' in diameter.
3	43	+ 10	50	30, <b>Tauri</b> . Primary 5 mag., companion 9 mag., distance 9".
3	43	+ 23	45	$\Sigma$ 453 ( <b>Atlas</b> ) in the <b>Pleiades</b> . A star, 4.5 mag. In 1827 and 1830 Struve fancied that he could distinguish a companion to this star of 8 mag., distance 0.8". It was, however, never seen afterwards by Struve or any other observer. Even Burnham always found the star to be single and perfectly round.
3	48	+ 31	35	$\zeta$ <b>Persei</b> . Quintuple. The primary, 2.7 mag., has, at distance 33", a companion 11 mag., at distance 89", another of 9 mag., and a third 10 mag. at distance 119".
3	49	- 3	14	32, <b>Eridani</b> . Primary 4.5 mag., yellow, with a companion 6 mag., distance 6.7", of a blueish colour. Discovered by W. Herschel in 1781. The two colours are very clearly distinguished.
3	51	+ 39	43	$\epsilon$ <b>Persei</b> . Primary 3 mag., companion 8 mag., distance 9". The companion is probably variable, its colour, too, is said to change from blue to red, but the matter requires further investigation.
3	53	+ 80	26	$\Sigma$ 460, <b>Cephei</b> . A very close double star, primary, 5 mag., companion 6 mag., distance 0.9".
3	55	+ 12	12	$\lambda$ <b>Tauri</b> . Found to be variable by Baxendell in 1848. It belongs to the Algol type. Period 4 days; the changes in brilliancy, however, only occupy 10 <sup>h</sup> ; magnitude at maximum 3.4, at minimum 4.2. It loses more quickly than it gains in brilliancy.
3	58	+ 60	39	801 (1501), <b>Nebula in Camelopardalis</b> . Rosse saw a star of 14 mag., surrounded by a nebular ring in the centre of this nebula. To observe this nebula in detail a most powerful telescope is required: even when examined by an 8-inch refractor it is very faint.
3	59	+ 62	5	$\Sigma$ 485, <b>Camelopardalis</b> . Two stars of about 6 mag. at 18" distance. A triple star ( $\Sigma$ 484), consisting of three stars of 9 mag., precedes them.
4	3	+ 49	15	809 (1513), <b>Star Cluster in Perseus</b> . Very beautiful and rich in stars, 7' in diameter, rather crowded and irregularly round in shape. This cluster is surrounded by a ring of faint stars, which cannot be well seen except with a very powerful instrument.
4	2	+ 14	54	$\Sigma$ 495, <b>Tauri</b> . Primary 6.5 mag., companion 9 mag., distance 4".
4	3	+ 39	31	813 (1514), <b>Nebulous Star in Taurus</b> . A star of 8 mag., surrounded by a faint nebula 3' in diameter.
4	8	+ 48	9	$\mu$ <b>Persei</b> . Discovered to be a double star by W. Herschel, 2 Aug., 1782. The primary is 4 mag. and white in colour, the companion, 8.5 mag., is at a distance 92". At Pulkowa another very faint companion was discovered, distance (according to Burnham) 14", position angle 349".
4	8	+ 59	59	820 (1528), <b>Star Cluster in Perseus</b> . Rich in stars, nearly 15' in diameter, rather crowded, with some fairly brilliant stars, apparently in curves: 30' to the south it is followed by a reddish-coloured star of 9 mag.
4	9	+ 9	1	47, <b>Tauri</b> . Primary 5 mag., companion 8 mag., distance only 0.8".

Right Ascension, 1900.		Declination, 1900.		
h.	m.	°	'	
4	10	+ 15	9	There is, in addition, a second very faint companion (12 mag.) at distance 32.2", position angle, 223°. This last was discovered by Burnham.
4	10	+ 15	9	4, <b>Tauri</b> . Up to 1872, J. Schmidt found that he could always make this star out with the naked eye as of 6 mag. In September, 1872, it decreased to 7 mag., and then again became visible to the naked eye, nor has any variation been observed in its brilliancy since 1874.
4	10	- 10	30	A <b>Eridani</b> . Primary 5 mag., and yellowish in colour, with a very faint companion 9 mag., distance 6.3". First discovered to be a double star by W. Herschel, 31 January, 1785.
4	10	- 13	0	826 (1535), <b>Nebula in Eridanus</b> . A planetary disc, of fair brilliancy. According to Lassell, there is a star of 12 mag. in the centre. Herschel, who discovered it in 1785, took it to be a star cluster, and its spectrum supports this view. The nebula is a very small one.
4	11	- 7	47	$\sigma^2$ <b>Eridani</b> . A star of 4.5 mag., with a companion 9 mag. d. = 82", p. = 106°, which is itself a double star. The two stars which compose it are at distance 3.6" from one another. Discovered by W. Herschel in 1783, with the help of a 6-inch reflector. This double gives indication of a strong proper motion, amounting lately to 4.05" per annum.
4	13	+ 50	0	831 (1545), <b>Star Cluster in Perseus</b> . The stars are coarsely scattered, fairly numerous, and many of them are of fair brilliancy. Discovered by W. Herschel, 28 Dec., 1790.
4	14	+ 27	7	$\phi$ <b>Tauri</b> . A double star, primary (which is reddish) 5.5 mag., companion 8.5 mag. Distance (in 1873) 5.4", position angle 246°.
4	17	+ 25	23	$\chi$ <b>Tauri</b> . A star 6 mag., with companion 8 mag., distance 19".
4	16	+ 19	18	<i>T</i> <b>Tauri</b> . A variable star of irregular period, discovered by Hind, 1861. It is preceded 1 <sup>m</sup> by a very remarkable variable nebula. This latter had been frequently seen since 1854, but in 1861 d'Arrest could not find any trace of it even with the great refractor at Copenhagen. According to Argelander, the star <i>T</i> was of 9.4 mag. in 1852; but since 1869 it has always been less than 11 mag.; its brilliancy has seemingly decreased at the same rate as that of the nebula, a noteworthy fact, since it seems to indicate some sort of relation between the two phenomena.
4	18	+ 34	5	$\Sigma$ 533, <b>Persei</b> . Primary 6 mag., companion 7.5 mag., distance 20".
4	19	+ 22	4	$\kappa$ <b>Tauri</b> . Two stars of 5 mag. and 6 mag. respectively, at distance 339" from one another; between the two there is a minute double star of 11.2 and 11.6 mag., distance 5".
4	23	+ 30	9	$\Sigma$ 548, <b>Tauri</b> . A double star of 6 and 8 mags., distance 14".
4	23	+ 9	56	<i>R</i> <b>Tauri</b> . First recognised as a variable star by Hind in 1849. It is of a deep red. At maximum it fluctuates between 7.4 and 9 mags.; at minimum it is less than 13 mag. Period of variability nearly 325½ days.
4	23	+ 15	44	$\theta^1$ <b>Tauri</b> . Two stars of 4 and 4.3 mags., distance 337". Can be recognised as a double star with the naked eye. In spite of their great apparent distance, the stars seem to stand in a physical relation to each other.
4	24	+ 53	42	1, <b>Camelopardalis</b> . A star of 6.1 mag., with a companion 6.2 mag., at distance 10.4".
4	25	+ 39	48	$\Sigma$ 552, <b>Persei</b> . A double star, 6 mag. and 6.5 mag., distance 9". Both stars are white.

Right Ascension 1900.		Declination 1900.		
h.	m.	°	'	
4	24	+ 15	25	80, <b>Tauri</b> , 6.5 mag. A very close double star, the companion, 7.5 mag., being, in 1879, only at distance 0.6", and this is continually decreasing.
4	26	+ 42	51	<i>m</i> <b>Persei</b> . Two stars of 5 mag and 6 mag., at distance 114". In Herschel's time these stars seem to have been much fainter.
4	30	+ 16	19	<i>a</i> <b>Tauri (Aldebaran)</b> . A red star 1 mag., with a very interesting spectrum (Vogel, Class IIa). It has a companion 10 mag., at distance 117", which Burnham resolved into two stars at a distance of 2". Burnham discovered a second companion at distance 31.4", position angle, 109°; but it is so faint as to be visible only in a most powerful telescope. From results of his spectrum photographs and measurements, Vogel considers <i>a</i> Tauri to be receding from our sun at the rate of over 39 miles per second.
4	30	+ 9	57	88, <b>Tauri</b> , 4.5 mag., with companion 8 mag., distance 69". Discovered by W. Herschel, 24 September, 1780.
4	32	+ 53	17	2, <b>Camelopardalis</b> , 5.5 mag., yellowish, with a blueish companion, 7.4 mag., distance (according to Engelmann, 1883), 1.9"; position angle, 292°.
4	34	+ 15	43	$\sigma$ <b>Tauri</b> . Two stars of 4.6 and 5.5 mags., distance 429"; can be divided by the naked eye.
4	36	+ 22	46	$\tau$ <b>Tauri</b> , 4.5 mag., with an easily distinguished companion, 7 mag., at distance 63". Discovered by Chr. Mayer.
4	39	- 8	59	55, <b>Eridani</b> . A star of 6 mag., with a companion, 7 mag., distance 9". The primary is yellowish, the companion white in colour. Found to be double by W. Herschel in 1783.
4	43	+ 10	45	905 (1662), <b>Star Cluster in Orion</b> , consisting of 18 stars of from 8 to 11 mag. Somewhat scattered. Vogel has measured their relative positions with the micrometer.
4	46	+ 17	22	<i>V</i> <b>Tauri</b> . A variable star, first recognised as such by Auwers, 1870. The star is reddish. At maximum it reaches 8.3 mag.; at minimum it diminishes to 13 mag. Period 170.6 days.
4	52	+ 53	36	7, <b>Camelopardalis</b> . A star of 4.5 mag., with a very faint companion (11.3 mag.), at distance 26". Dembowski, in 1864, discovered that the primary was itself a double star, having a companion of 8 mag. at distance 1.2".
4	51	- 5	29	<i>b</i> <b>Eridani</b> , 6 mag., with companion 8 mag., distance 64".
4	53	+ 37	44	4, <b>Aurigae</b> . A star 5.5 mag., giving a greenish light, with a companion 7 mag., distance 6". First recognised as a double star by W. Herschel, 30 October, 1779.
4	54	+ 7	59	<i>R</i> <b>Orionis</b> . A variable star, of a deep red colour, discovered by Hind in 1848. At maximum it reaches almost 9 mag., at minimum it is less than 13. Period, 380 days. According to Schoenfeld, the increase in brilliancy from 10 mag. upwards occupies 70 days; the decrease from maximum to 10 mag., 105 days.
4	55	+ 52	44	940 (1708), <b>Star Cluster in Camelopardalis</b> . Fairly large and conspicuous. The stars are of various magnitudes, and are closer together towards the centre.
4	55	+ 43	41	$\epsilon$ <b>Aurigae</b> . Recognised as variable by Schmidt and Heis. The star

Right Ascension. 1900.		Declination. 1900.		
h.	m.	°	'	
				is 3 mag., but has been seen at times as a star of 4.5 mag. The variations of brilliancy are, however, very irregular, and are often for a long time imperceptible.
4	55	- 14	57	<i>R Leporis</i> . A variable star of a bright red colour, called a "crimson star" by Hind. Schmidt, in 1855, was the first to recognise it as variable. The period is about 436 days, but seems to be very irregular. At maximum the star is 6 to 7, at minimum 8.5 mag. It has a remarkable spectrum of Vogel's Class IIIb., in which broad absorption bands of the hydrocarbons appear.
4	55	+ 3	28	Σ 627, <b>Orionis</b> , 6.5 mag., with a companion of nearly 7 mag., at distance 21". This latter has not undergone any perceptible change since 1831.
5	2	+ 1	2	96 B, <b>Orionis</b> . A remarkable red-coloured star, estimated by Lalande and Bessel as of 7 mag., but by Birmingham, in 1871, as of 6 mag. The red tint is also probably slightly variable.
5	1	+ 36	55	996 (1778), <b>Star Cluster in Auriga</b> . This is really not a cluster, but rather a rich field of stars. Herschel first saw it 17 January, 1787. The most brilliant stars contained in it are of 7.5 mag., the faintest 11.5 mag.
5	2	- 3	29	1005 (1788), <b>Nebula in Orion</b> . Fairly brilliant, 3' in diameter, and gradually fading towards the edges. It forms a triangle with two stars, 10 mag. and 12 mag. respectively. Discovered by Herschel, 2 January, 1786.
5	3	+ 8	22	14, <b>Orionis</b> . A star of 6 mag., with a companion 7 mag., at distance 1.1", position angle, 205°.
5	4	+ 27	54	Σ 645, <b>Aurigae</b> . A double star, primary 6 mag., companion 8 mag., distance 12", position angle, 27°.
5	12	+ 79	7	Σ 634, <b>Camelopardalis</b> . A star of 5 mag., with a companion 8 mag. In 1834 the distance was 34.5", but in 1880 it was only 20"; position angle 2°.
5	6	+ 16	35	1030 (1817), <b>Star Cluster in Taurus</b> , 20' to 25' in diameter, rich and fairly crowded with stars ranging from 11 to 14 mag. Discovered by Herschel, 19 February, 1784.
5	7	+ 0	55	Σ 652, <b>Orionis</b> . A double star, primary 6.5 mag., companion 8 mag., distance 1.7", position angle 184°.
5	8	+ 2	45	ε <b>Orionis</b> . A yellow star, 4.7 mag., with a companion 8.5 mag., of a blueish white; distance 7". No change has been observed in the position of the companion since Herschel's time. It is an easy object for powerful telescopes.
5	8	- 11	59	ι <b>Leporis</b> . A greenish star, 4.5 mag., with a faint companion 10.5 mag.; distance 13". This distance does not seem to vary. The position angle, 338°, also seems to be nearly invariable.
5	9	+ 53	28	<i>R Aurigae</i> . A variable star, first recognised as such at Bonn Observatory in 1862. At maximum it reaches 6.5 to 7.8 mag., at minimum it is almost 13. Period 460 days. The changes in brilliancy are sometimes very peculiar.
5	9	+ 45	55	α <b>Aurigae (Capella)</b> . A white star, 1 mag., with companion 9 mag.; distance 158", position angle 146° (discovered by Herschel). Burnham found two other very faint companions, magnitudes 12 and 13, distances

Right Ascension, 1900.		Declination, 1900.								
h.	m.	°	'							
				78" and 126", position angles 317° and 183° respectively. Struve (in 1804) conjectured that Capella had become more brilliant than formerly, and that it was at one time fainter than Vega. J. Herschel supported this theory. Capella's spectrum is similar to that of the sun, even to the smallest detail. Newall, of Cambridge, from examination of its spectrum, concluded that Capella is a spectroscopic double, and that its period of revolution is 104 days. It had been observed in Greenwich that there was a slight broadening of the light of Capella, indicating a close companion at a calculated distance of 0.8".						
5	9	+ 32	35	14, <b>Aurigae</b> . Triple. The primary, 5.5 mag., has a companion 7 mag., at distance 14.5". This was first seen by W. Herschel, 24 Sept., 1780. Struve, in 1830, discovered another very faint companion (11 mag.) at distance 12.6", position angle 342°.						
5	9	- 13	3	$\kappa$ <b>Leporis</b> . A double star, primary 5, companion 8 mag., distance 3". According to Struve, the primary is yellowish, the companion blueish.						
5	10	+ 8	19	$\beta$ <b>Orionis (Rigel)</b> . A brilliant star, 1 mag., with a companion 8 mag., distance 9.6". Discovered by W. Herschel, and a very beautiful object in a powerful telescope. The companion, as remarked by Burnham in 1871, is itself a double star, but it is such a difficult object that Burnham himself, with the 18-inch refractor at Chicago, only at times succeeded in "dividing" it. Other observers have so far been unable to do so. Aitken again saw the companion in the 36-inch telescope in 1890, and found in 1900 distance = 0.1", p. = 196°. There is yet another very faint star at distance 44", position angle 1.5°. According to Seidel, $\beta$ is in a slight degree variable. Huggins discovered in the photograph of $\beta$ 's spectrum 10 lines which corresponded with the lines of oxygen, also lines of nitrogen.						
5	12	+ 20	1	$\Sigma$ 674, <b>Tauri</b> . A star of 6.5 mag., with a companion 9 mag., distance 10.5", position angle 147.3°.						
5	12	+ 40	11	$\lambda$ <b>Aurigae</b> , 6 mag., with a companion 9 mag., distance 122". Burnham found yet another very faint star at distance 40", position angle 198°.						
5	13	+ 39	14	1067 (1851), <b>Star Cluster in Auriga</b> . A beautiful group of stars, slightly denser towards the centre. A star of 7 mag., outshines all the others. Discovered by Herschel, 18 October, 1786.						
5	13	+ 46	52	$\Sigma$ 681, <b>Aurigae</b> . A double star, primary 6.5 mag., companion 9 mag., distance 23.2", position angle 181°.						
5	13	- 6	57	$\tau$ <b>Orionis</b> . This star, 4 mag., has two very faint companions. Burnham, 1899, gives the following measurements:— <div style="margin-left: 40px;"> <table border="0"> <tr> <td>A B.</td> <td>Distance 35"</td> <td>Position angle 250</td> </tr> <tr> <td>A C</td> <td>" 36"</td> <td>" 60"</td> </tr> </table> </div> It was Burnham who discovered that B is a double star: 10.5 mag. and 11 mag.; d. = 3.8", p. = 51°.	A B.	Distance 35"	Position angle 250	A C	" 36"	" 60"
A B.	Distance 35"	Position angle 250								
A C	" 36"	" 60"								
5	18	+ 3	27	$m$ <b>Orionis</b> . A greenish-white star, 5 mag., with a companion (white) 7 mag., distance 31.7", position angle 28.1°. No change of position has as yet been observed.						
5	19	+ 17	18	111, <b>Tauri</b> . A star of 5.5 mag., with a companion 8 mag., distance 75", position angle 271°. Herschel had already made the measurements.						
5	18	- 24	52	<b>Triple Star in Lepus</b> . The primary is 6 mag., the nearer companion,						

Right Ascension, 1900.		Declination, 1900.		
h.	m.	°	'	
				which is at distance 3.5", is 9 mag., the farther companion, which is at distance 59", is 8.5 mag.
5	19	+	33 17	1101 (1893), <b>Star Cluster in Auriga</b> . Fairly large, and rich in stars, slightly denser towards the centre.
5	19	-	2 29	$\eta$ <b>Orionis</b> , 3.5 mag., with a companion 10 mag., at distance 110". Dawes, in 1848, discovered that the primary was itself a double star, having a companion of 5.5 mag. at distance 1". It requires a strong instrument to "divide" this star.
5	19	+	6 16	$\gamma$ <b>Orionis</b> . A star of 2 mag., supposed by J. Herschel to be slightly variable. Gould, too, finds slight variations, but only of about $\frac{1}{3}$ mag.
5	20	-	24 37	1112 (1904), <b>Star Cluster in Lepus</b> . A splendid globular cluster discovered by Méchain, which Messier described as a starless nebula with a brilliant centre. Herschel was the first to resolve the nebula into stars. From photographs taken at Arequipa it appears that 5 stars out of the 200 of this cluster are variable.
5	21	+	35 13	1114 (1907), <b>Star Cluster in Auriga</b> . A somewhat crowded circular cluster, 4' in diameter, consisting of small stars ranging in magnitude from 9 to 12. Discovered by W. Herschel, 17 January, 1787.
5	22	+	3 0	$\psi^2$ <b>Orionis</b> . A star of 5.5 mag., with a very faint companion of 11 mag., distance 2.9", position angle 322°.
5	22	+	35 45	1119 (1912), <b>Star Cluster in Auriga</b> . A beautiful object, about 10' in diameter. Discovered by Messier. A brilliant star may be observed in the centre. The stars are of unequal brilliancy. Its form, according to Messier, is quadratic. The cluster is not at all nebulous if examined with a powerful telescope.
5	23	+	25 4	118, <b>Tauri</b> . A double star, primary 6 mag., companion 6.5 mag. Discovered by Herschel in 1782, but since his time the position of the companion has undergone little or no change. Distance 5", position angle 200°.
5	24	-	20 51	$\beta$ <b>Leporis</b> . A triple, the components being of 3, 10, and 11 mags., at distance 3" and 66" respectively. The innermost companion was discovered by Burnham, the outer one by John Herschel. Burnham observed also two stars of 10 mag. at distances 206" and 210" respectively.
5	25	-	1 10	31, <b>Orionis</b> . A double star, primary 5.5 mag., companion 10 mag., distance 12.7", position angle 88.4°. The primary is reddish in colour and apparently variable; at least Gould at Cordova estimated its magnitude at various times as 4.7 mag. to 6 mag.
5	25	+	5 52	$\lambda$ 32, <b>Orionis</b> , 5.2 mag., with a companion 6.7 mag., distance (in 1878) only 0.6". In W. Herschel's time the distance was more than 1".
5	25	+	34 10	1137 (1931), <b>Nebula in Auriga</b> . A large, brilliant, circular nebula, with a slightly increased brilliancy at the centre, where there is a triple star. The whole is 5' in diameter. Discovered by Herschel 4 February, 1793. According to Brodie the nebula is very faint.
5	26	+	3 13	$\eta$ 33, <b>Orionis</b> , 6 mag., with a companion of 7 mag., at distance 1.9". Not easy to observe with an ordinary telescope.
5	26	+	16 59	$\Sigma$ 730, <b>Tauri</b> . A double star, 6.5 and 7 mags. Distance 9.8", position angle 142°.
5	26	+	30 22	<b>Nova Aurigae</b> . This star was found to be new on 23 January, 1892,

Right Ascension, 1900.	Declination, 1900.
5 27	- 0 22
5 28	- 17 54
5 29	+ 21 57
5 30	+ 34 4
5 30	+ 9 52

by Dr. Anderson, with the help of the present Star Atlas. It was then 4 mag., but by the end of February had decreased in brilliancy to mag. 6, after which it rapidly became feebler, until in April it was only 14 mag. By August, 1892, it had increased in brilliancy to 9.2 mag., and remained thus until the middle of 1894, when it began again to become feebler—almost to the point of vanishing. The prints of the photographs of the heavens taken regularly at the Harvard Observatory (Cambridge, U.S.A.) showed afterwards that this star on December 1, 1891, was of 6 mag., and on 20 December of 4.4 mag., and that it had afterwards increased in brightness. It is remarkable that no one had recognised it as a Nova before Dr. Anderson. The spectrum of this star was examined by Huggins, also at the Harvard and Lick Observatories, and at Potsdam and Polkowa, photographs being taken of it. It gave both bright and dark lines, especially hydrogen lines, but all of them were shifted from their original position, whence it was concluded that the spectrum consisted really of the superimposed spectra of two stars, and that both bodies were moving away from the earth in the line of sight. Later physical investigations have, moreover, shown that, with indications of strong pressure in the spectrum of the metals, bright and dark lines appeared in couples, exactly as in the observed spectra of other Novæ. Owing to the appearance of the spectrum of these bodies, we can no longer conclude that the outbreak of this Nova was the result of the rapid approach in their orbits, or the coming together, of two cosmical bodies. The cause of the outburst of light of this (and other Novæ) remains, however, still doubtful. From the observations at the Lick Observatory in August, 1892, the spectrum of this Nova bore fully the character of that of a planetary nebula.

**♂ Orionis.** A double star, 2.5 and 6.8 mags. Distance 53". Burnham lately noticed yet another companion of between 13.5 mag., distance 32", and remarks that this is one of the faintest that he has ever seen near a brilliant star. The primary is variable, but only to the extent of half a magnitude, and the period is irregular.

**α Leporis.** Yellowish, 4 mag., with a companion of 10 mag. at distance 35", position angle 156°.

1157 (1952), **Nebula in Taurus.** Seen as far back as 1731, by Messier, but imperfectly, and described by him as a starless nebula, something like a dull flame. W. Herschel thought it capable of being resolved, and alluded to it as a magnificent object. Lord Rosse, with his great telescope, was the first to obtain an exact view of the nebula; he compared its appearance to that of a crab (crab-nebula); he saw several very minute stars in it, and gave a drawing of the whole. Dreyer, however, asserts that all the former representations of this nebula fail to give a satisfactory description of its appearance as seen through a telescope of the highest power.

1166 (1960), **Star Cluster in Auriga.** Near the star  $\eta$ . A cluster 9' in diameter, a very fine view of which may be obtained with a 3½ inch refractor. The stars are from 7 to 11 mag., the double star  $\Sigma$  737 (8 and 9 mags., distance 10.6") being among them.

**λ Orionis.** A yellowish-white star, 3.5 mag., with a reddish companion 6 mag., distance 4". This latter had already been seen by Herschel,

Right Ascension 1900.		Declination. 1900.	
h.	m.	°	'
5	30	—	6 4
5	30	—	5 28

Struve found another very faint star (10 mag.), distance 28", position angle 184°; and another of 10.5 mag., distance 149", position angle 278°.

Σ 747, **Orionis**. A double star, 5.6' and 6.5 mags., distance 36". The position of the companion has not changed since 1833.

1179 (1976), **The Great Nebula in Orion**. The most conspicuous and interesting object of its kind in the Northern heavens, and an inexhaustible field of research to all who have a powerful telescope at their disposal. No description can give an adequate picture of this nebula. The earlier accounts given by De Vico, Herschel, and others are not satisfactory. Only the sketches given by Rosse, Bond, and Tempel, can be considered at all adequate. In Sheet xiv. will be found a reproduction of Bond's masterpiece. This map was obtained with the help of a 14-inch refractor, a first-class instrument, though far inferior to Rosse's 6-foot reflecting telescope in point of illuminating power. Nevertheless, this latter failed to discover any additional feature of importance. Bond's drawing covers an area of  $3\frac{1}{2}^{\circ}$  square. Taking the quadruple star,  $\theta$  Orionis (Σ 748), which forms the celebrated Trapezium, as a starting-point, this area extends 2' 15" on both sides in Right Ascension, and 1° 30' in Declination to the north and south respectively. The chief nebula round  $\theta$  seems to be connected with the nebulae round  $c$  and  $\epsilon$ ; at least the observations of Rosse and Bond point to this conclusion, while Herschel is undecided. G. P. Bond has given a list of 1101 stars, all of which, however, are in positions where his refractor showed nebular matter connected with the great nebula. Bond has also pointed out a kind of spiral structure in certain portions of the Orion nebula. This shows itself in narrow, crooked streaks, of which several frequently proceed from a common centre. Since Herschel's time, many attempts have been made to resolve the nebula in Orion into separate stars; especially has the part south of the Trapezium, which is generally called after the astronomer Huyghens, and of which the most brilliant portion seems to be drawn out into a rhomboidal or lozenge shape, been carefully examined with the most powerful telescopes with a view to disintegration. For a long time it was reported that Lord Rosse's great telescope had succeeded in resolving this portion of the nebula into a star cluster, but this was not the case. Rosse and his collaborateur, Hunter, succeeded only in discovering faint luminous points in individual places where no stars had been seen previously. Finally, spectrum analysis has proved that the nebula is composed principally of masses of luminous gas. The central portion may be said to be marked off by the four brilliant stars which compose the celebrated Trapezium, which, standing on a dark background, are surrounded by masses of luminous nebula. The elder Herschel, who began his astronomical labours by measuring the distances of the stars in the Trapezium, never observed more than four stars there. Struve saw a fifth (12 mag.) in 1826; Sir John Herschel and South in 1832 discovered a sixth of 13 mag.; and De Vico in 1839 saw three others, but these have never since been again observed even in the most powerful telescopes. Lamont also discovered two stars which could be considered as belonging to the Trapezium, and Lassell, at Malta, 2 January, 1862, another



Right Ascension, 1900.	Declination, 1900.
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h	m
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very faint star, so that altogether the total number of stars belonging to the Trapezium, which have been observed within a space of 4 minutes square amount to 11 or 12. These, however, have never been visible at the same time to one observer. Moreover, Burnham, who is unquestionably one of the ablest, if not the most able, observer in this particular field, absolutely declines to admit that more than six stars are visible in the Trapezium, and considers the observations which oppose this theory to be untrustworthy. He likewise refuses to credit the supposed variability of the fifth or sixth star. This last he thinks to be of 12 mag. By the 36-inch instrument at the Lick Observatory, two excessively feeble stars were discovered within the Trapezium. In no other telescope up to the present have these stars been seen. They are of 16 to 17 mag. The spectrum of the Orion nebula shows bright hydrogen lines. The nebula has been frequently photographed, the best photographs having been obtained at Arequipa (Peru), and at the Harvard and Lick Observatories (1898). From the Lick photographs, it appears that the nebula extends far beyond the limits immediately assigned to it by the naked eye, or even in the most powerful telescopes.

5	31	-	4	25
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1184 (1981), **Star Cluster in Orion**. An extended group of stars, of 6 and 7 mags., besides some fainter ones. Among them is a double star ( $\Sigma$  750), 6 and 9 mags., distance 43".

5	31	-	5	59
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$\epsilon$  **Orionis**. A triple star, primary, 3.5 mag., companions, 7 and 9.5 mags. W. Herschel saw only the companion of 7 mag. at distance 11.3". The farther and fainter companion (distance 50") was observed by South in 1824.

5	31	-	5	20
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1185 (1982), **Nebula in Orion**. Fairly brilliant and large, brighter towards the centre, where there is a star of 8 mag. Messier had observed this object, and described it as a star with a nebulous envelope.

5	32	+	21	9
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1191 (1988), **Variable Nebula in Taurus**. A star of 11 mag. was observed in this place by Chacornac in 1852, but without any trace of nebula. Next year he saw the star again, this time surrounded by nebula; on 27 June, 1856, the nebula had become very brilliant, but in 1862 it had entirely disappeared, and has not since been observed. The star (11 mag.) has not been observed to vary.

5	31	-	1	16
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1193 (1990), **Nebula round  $\epsilon$  Orionis**. On January 2, 1786, W. Herschel writes in his diary that he is nearly certain that  $\epsilon$  Orionis is surrounded by an irregularly blurred, milky mass of nebula. This observation was, as it turned out, a correct one; several other observers have noticed the faint nebula round the star. Rosse's great telescope showed it in 1850 and 1852; but in 1874 and 1878, in spite of many efforts, it was impossible to distinguish it, even with this instrument.  $\epsilon$  Orionis has besides a faint companion, of 9 mag., distance 3', position angle 57°.

5	32	+	25	46
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1199 (1996), **Star Cluster in Taurus**. A large cluster, 15' in diameter. The stars are all of nearly equal magnitude, and evenly distributed, but not very numerous. Discovered by Herschel, 7 December, 1785.

5	32	+	30	26
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26, **Aurigae**. A double star, 6 and 8 mags., distance 12". Discovered by W. Herschel in 1782. Burnham found also a small star, 11 mag., distance 26", position angle 113°.

5	31	-	2	39
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$\sigma$  **Orionis**. A multiple star, really a group consisting of two multiple

Right  
Ascension,  
1900.      Declination,  
1900.

h.      m.

stars. The primary ( $\Sigma$  762) is 4 mag., and has one companion B (5 mag.), distance 0.2", position angle 332°; another C (9.5 mag.), distance 11", position angle 237°; another companion D (7 mag.), distance 13", position angle 83°; another E. (6.3 mag.), distance 41", position angle 61°. The second group is at a distance 210", position angle 322°. The three most brilliant stars of this are 8.5 mag. Between these two groups a powerful instrument shows two faint stars.

45, **Leporis, a Multiple Star.** Described by J. Herschel as quintuple, but it has other companions as well, though they are very faint; they were first discovered by Burnham. The latter gives the following magnitudes: A 6.8, B 7.3, C 9, D 9.8, E 8, F 8, G 10, H 13, mags. When Burnham directed his attention to this system of stars, he saw at a glance that A and B were each of them double stars. The following measurements give the relative positions of the various stars belonging to the system. d. = distance, p. = position angle.

	d.	p.		d.	p.
A B	0.9"	143°	A F	126.5"	299°
C D	1.4"	359	A G	60.3"	49°
A C	89.3"	137°	A H	41.0"	306°
A E	76.2"	6°			

J. Herschel saw only the stars A, B, C, D, E.

$\zeta$  **Orionis.** A beautiful double star, 2 and 5.7 mags., distance 2.6", discovered by Kunowsky in 1819. Changes in the position of the companion cannot be affirmed with certainty. A star of 9 mag. stands at distance 57", position angle 9°.

1225 (2022), **Nebula in Orion.** Not very brilliant, small, planetary; seen with a low power, it resembles a star of large diameter. Herschel saw it 28 December, 1785, with a magnifying power of 240, as an ill-defined, planetary nebula. It is preceded by several small stars. Lord Rosse conjectures that it is a star-cluster at an immeasurable distance.

1226 (2023), **Nebula in Orion.** A star of fair brilliancy, in the middle of a nebula 5' long by 4' broad. Discovered by W. Herschel, 6 January, 1785.

1227 (2024), **Nebula in Orion.** Irregular, of fair brilliancy and size, with a dark space in centre. Discovered by W. Herschel, 1 January, 1786, who described it as a remarkable, milky, nebulous mass, divided into 3 or 4 large strips, which surround a dark space. He estimated its size at not less than  $\frac{1}{2}$ ", and thought it was probably much larger. This nebula follows a little to the north of  $\zeta$  Orionis, and when viewed with a low magnifying power, comes into the field of vision at the same moment. Sheet xviii. shows this nebula as it appeared to Tempel at Florence.

$\gamma$  **Leporis.** Primary, 5 mag., somewhat yellowish: at distance 93", position angle 349°, is a star of 7 mag.; at a distance of 135" there is a third star (12 mag.).

$\Sigma$  780, **Camelopardalis.** A triple star, discovered by Struve. Primary (A) is 7 mag., the nearer companion (B) 8.5 mag., the farther (C) 12 mag. Struve, in 1831, gave the following measurements: A B, d. = 3.7", p. = 103.5°; A C, d. = 10.9", p. = 154.8°.

5 35 - 17 54

5 36 - 1 59

5 37 + 9 2

5 37 - 2 17

5 37 - 1 54

5 40 - 22 20

5 41 + 65 44

Bright Asterisms 1900.		Declination, 1900.		
h	m	+	'	
5	42	+	0	1 1267 (2068), <b>Nebula in Orion</b> . Seen by Méchain in 1780, and described as consisting of two brilliant stars surrounded by nebula. In it there is a double star, 8 and 8.5 mags., 51" distance. Burnham found that the companion is itself double; distance 1.7".
5	43	+	6	25 52, <b>Orionis</b> . A star of 6 mag., with a companion of 7 mag., distance 1.5". Discovered by Herschel, 1 October, 1781; the companion can be seen with a 3½-inch telescope.
5	46	+	32	31 1295 (2099), <b>Star Cluster in Auriga</b> . Discovered by Messier, and a splendid object. Seen with a pocket-telescope, it looks like a nebulous star. Messier says that the stars are very crowded, and slightly mingled with nebula. They are of 10 mag. and under. Over 500 may be seen with a powerful telescope. Diameter of the whole, 20".
5	50	+	5	50 Σ 816, <b>Orionis</b> . A double star, 6 and 8.5 mags. Distance 4", position angle, according to Struve (1830), 289°.
5	49	+	0	22 1310 (2112), <b>Star Cluster in Orion</b> , 7' to 8' in diameter. The stars are, however, small and somewhat crowded.
5	50	+	7	22 <b>α Orionis (Betelgeux)</b> . A brilliant red star, 1 mag., which (as discovered by W. Herschel) has a companion of 10 mag. at distance 152". Burnham saw, besides this, several much fainter stars nearer to <i>α</i> . Betelgeux is variable, as discovered by J. Herschel in 1836, but the period of variability seems to be very irregular. The star has an interesting spectrum, Typ. III., which has been carefully studied by Huggins.
5	52	+	44	57 β <b>Aurigae</b> . The spectrum of this star exhibits periodical doubling of its lines, showing that β is a double star which cannot be divided by the telescope, and is only recognised as such spectroscopically. The period of revolution amounts to only 4 days.
5	53	+	37	13 θ <b>Aurigae</b> . A triple star. Primary, 4 mag., nearer companion 7 mag. The farther, 9 mag. The distance of the former is 2", of the latter 45". According to O. Struve, there is a fourth star 10 mag. at distance 125", position angle 350°.
5	55	+	23	18 1325 (2129), <b>Star Cluster in Gemini</b> . A cluster of 6' to 7' in diameter, containing coarsely scattered stars of 7 to 11 mag. W. Herschel discovered it 16 November, 1784.
6	3	+	24	21 1360 (2168), <b>Star Cluster in Gemini</b> . A very splendid object, seen by Messier, 20' in diameter. The most brilliant stars in it are of 9 mag. The field of vision is, however, filled with stars ranging from this magnitude to the faintest points of light.
6	3	+	13	59 1361 (2169), <b>Star Cluster in Orion</b> . Fairly large, consisting of about 30 stars of 9 to 10 mag., among others a double star Σ 848 of 7 and 8 mags., distance 2.3". This is a little north of the centre of the cluster.
6	4	+	48	44 41, <b>Aurigae</b> . A double star, 5 and 6.5 mags., discovered by Herschel. The distance (8.0") and position angle (353°) do not seem to vary.
6	1	+	2	31 Σ 855, <b>Orionis</b> , 6 mag., with a companion 7 mag., distance 29", position angle 113°.
6	1	-	11	8 ‡, <b>Monocerotis</b> . A triple star; the nearer companion discovered by Burnham; the farther by Knott. Primary A is 6.5, B 10.5, C 11 mag. Measurements according to Aitken, 1899:



Right Ascension, 1900		Declination, 1900.	
6	27	+ 4 56	1424 (2244), <b>Star Cluster in Monoceros</b> . Visible on a clear night, with the naked eye, as a nebulous star. With a telescope is seen to be a somewhat dense cluster of stars, one of which (12 Monocerotis) is of 6 mag.
6	27	+ 10 14	1452 (2245), <b>Nebula in Monoceros</b> . A very interesting object, fairly bright, comet-shaped, or rather fan-shaped, extending from a star of 10 to 11 mag. The whole is probably $1\frac{1}{2}$ ' long.
6	29	+ 7 39	11, <b>Monocerotis</b> . Yellowish-white, 6.5 mag., with a very faint companion (12 mag.). Distance 11", position angle 209.9°.
6	30	+ 38 32	<b>Star in Auriga</b> , 6.3 mag., with a spectrum of the Class IIIb. of Vogel, in which broad absorption bands of hydrocarbons are visible.
6	32	+ 16 29	$\gamma$ <b>Geminorum</b> , a star of 2.5 mag. with 2 faint companions at a considerable distance. Burnham gives the following measurements:— A B, distance 141.7"      Position angle 335.5 A C    „    294.7"      „      133.0
6	33	+ 10 58	1435 (2259), <b>Star Cluster in Monoceros</b> . Large, containing about 40 stars of 9.5 to 12 mag., which are irregularly distributed.
6	36	+ 9 59	<i>S</i> (15) <b>Monocerotis</b> . The chief star of a coarsely scattered star cluster, 6 mag., with two companions, one 9 mag., distance 3", the other 11.5 mag., distance 16". The primary is surrounded by a thin veil of nebula, and, as discovered by Winnecke, varies about half a magnitude. The duration of light variability is only 3 days, 10 <sup>h</sup> 38 <sup>m</sup> . The colour of this star is described by Struve as green; it is now yellowish.
6	37	+ 59 33	12, <b>Lyncis</b> . Triple, 5.5, 6.1, and 7.4 mags. Discovered by W. Herschel in 1780. The nearest companion is at a distance 1.4"; the further at distance 8.7".
6	38	+ 25 13	$\epsilon$ <b>Geminorum</b> . This white star, of 3.5 mag., has a companion of 9 mag., at distance 111", position angle 94°.
6	40	+ 43 40	56, <b>Aurigae</b> , 5.5 mag., of a clear white colour, with a bluish-white companion 8 mag., at distance 48", position angle 21°.
6	40	+ 55 49	$\Sigma$ 958, <b>Lyncis</b> , 6 mag., consisting of two white stars of almost equal magnitude, at distance 5".
6	41	- 16 34	$\alpha$ <b>Canis Majoris (Sirius)</b> . The most brilliant star in the heavens, and at the same time the most remarkable of the double stars, for Bessel showed, from extremely careful observations made in 1843, that Sirius has a very slight periodical motion, which could be explained only on the assumption of its being a double star, the relatively feeble companion being invisible. This assumption has been fully confirmed since, for Clark, on 31 January, 1862, discovered with his 18½-inch refractor this companion as a star of 10 mag. The period of revolution is 48.8 years, and the distance of Sirius from the common centre of gravity of both stars, 2.3". If we assume the parallax of Sirius to be 0.193", the true distance separating the two bodies would be 37 radii of the earth's orbit round the sun. The mass of Sirius is 14 times that of the sun, and of its companion 7 times. The distance of Sirius from the earth is so great that it would require 16 years for light to traverse it. The spectrum of Sirius shows numerous fine dark lines, of which many correspond in position with the lines of iron, magnesium, and

Right Ascension 1900.		Declination.		
h.	m.	°	'	
				barium. Besides the companion of Bessel's calculation, Burnham saw in the neighbourhood of Sirius, through the Yerkes 40-inch instrument, a number of extremely feeble stars of the 13 to 16 mag.
6	42	+ 41	10	1451 (2281), <b>Star Cluster in Auriga</b> . Fairly rich, coarsely scattered, with a double star near the middle. Discovered by W. Herschel, 3 February, 1788.
6	43	- 3	4	1453 (2286), <b>Star Cluster in Monoceros</b> . Coarsely scattered, not rich, contains stars of 8 to 11 mag.
6	43	- 20	38	1454 (2287), <b>Star Cluster in Canis Major</b> . A magnificent object, described and recognised as a star cluster by Messier. The smallest astronomical telescope will suffice to distinguish separate stars in it. Seen with the lowest power of a refractor, the whole field of vision seems full of stars of various magnitudes. A splendid sight!
6	44	+ 59	34	14, <b>Lyncis</b> . A very difficult double star. The primary is 6 mag., and of a golden colour; the companion 7.1 mag., and of a purple red, according to Struve. Distance 0.9", position angle 51°; the latter is slowly increasing, while the distance seems to diminish. A powerful instrument is required to divide the companion from the primary.
6	47	+ 0	35	1465 (2301), <b>Star Cluster in Monoceros</b> , 20' in diameter, rich in small stars. Near the centre there is a triple star 8 and 9 mags., for which Burnham (1880) gives the following measurements: A B, distance 20.9", position angle 80°; A C, distance 8.6", position angle 281.9°.
6	49	+ 13	19	38, <b>Geminorum</b> . Primary, 5.4 mag. and yellowish, companion 7.7 mag. and blueish. Distance 6.3", position angle 162° (1890). The colours of both stars are relatively intense.
6	49	+ 18	8	1467 (2304), <b>Star Cluster in Gemini</b> . A triangular cluster consisting of small stars densely crowded. The whole, in the average telescope, looks like a nebula. Discovered by W. Herschel, 30 December, 1783.
6	52	- 13	55	$\mu$ <b>Canis Majoris</b> . A yellowish star 4.7 mag., with a blueish companion 8 mag., distance 3" (1887), slowly decreasing, position angle 340°.
6	53	+ 10	24	1474 (2312), <b>Star Cluster in Monoceros</b> , consisting of a large number of coarsely scattered stars of 10 to 11 mag.
6	55	- 13	34	1479 (2318), <b>Star Cluster in Canis Major</b> . Somewhat scattered, 20' in diameter. The stars are from 8 to 11 mag. Discovered by Herschel, 8 February, 1785.
6	58	+ 52	53	$\Sigma$ 1009, <b>Lyncis</b> . A double star, 6.7 and 6.8 mags., both of a brilliant white colour. Distance 3", position angle 159°; this latter has probably decreased since Struve took the measurement in 1830.
6	58	+ 20	43	$\zeta$ <b>Geminorum</b> . A star of a deep yellow colour, 4 mag., recognised as variable by J. Schmidt in 1844. The variation of brightness = 0.8 mag., and lasts 10 days 3 <sup>h</sup> 42 <sup>m</sup> . The decrease in brilliancy is somewhat more rapid than the increase. $\zeta$ has two companions, 7 and 10.5 mags. The first at distance 94", position angle 352°, the latter 87", position angle 84°.
6	58	- 8	12	1483 (2323), <b>Star Cluster in Monoceros</b> . Discovered by Messier, 5 April, 1772, and described by him as a cluster of small stars of different magnitudes, near to a star of 7 mag. The cluster consists of stars ranging from 8 to 13 mag., one of them being red in colour. Diameter 30'.

Right Ascension 1900.	Declination 1900.	
6 6	59	- 15 29 $\gamma$ <b>Canis Majoris.</b> According to Montanari, this star was scarcely visible in 1670; in 1693 Maraldi found it to be 4 mag. Later on Flamsteed estimated it at 4.5 mag. and Flousteed at 5 mag. It is apparently variable.
7	1	+ 22 52 $R$ <b>Geminorum.</b> A variable star, discovered by Hind in 1814. At maximum it is 6.5 mag., at minimum less than 13 mag. The star is of a deep red colour, and the variation in brilliancy is 370 days. According to Schoenfeld, the brilliancy of the star at maximum is often the same for weeks at a time.
7	1	+ 27 21 1490 (2331), <b>Star Cluster in Gemini.</b> Discovered by W. Herschel, 11 March, 1785. A coarsely scattered cluster which contains within itself another cluster of small size. This latter, Rosse says, consists of six or seven stars of from 10 to 12 mag.
7	3	+ 10 11 $R$ <b>Canis Minoris.</b> A variable star, discovered at Bonn Observatory in 1854. At maximum it scarcely reaches 7 mag.; at minimum it is 9.5, sometimes 10 mag. Period, about 338 days. This star has so far received but little attention.
7	4	- 26 14 $\delta$ <b>Canis Majoris.</b> A red star, 2 mag., considered by Gould to be variable.
7	11	+ 13 57 1508 (2355), <b>Star Cluster in Gemini</b> , consisting of numerous stars of 10 mag. and under. Irregularly round in shape and rather denser towards the centre. The whole is 4' in diameter.
7	12	+ 16 43 $\lambda$ <b>Geminorum.</b> A star of 3.5 mag., of a greenish-blue light, with a companion 10.3 mag., distance 10", position angle 31°.
7	19	+ 73 16 $\Sigma$ 1051, <b>Camelopardalis.</b> Triple; found to be so by Struve. The primary is 7, the nearer companion 9, the farther 7 mag. The former is at distance 1.2", position angle 268°, the latter at distance 31", position angle 81.5°.
7	13	- 13 2 1511 (2359), <b>Nebula in Canis Major.</b> A large nebula, discovered by W. Herschel, 31 January, 1785, and described by him as resembling a parallelogram in shape, with a streak towards the south. The nebula has been imperfectly sketched by J. Herschel and Lassell. The best representation is that of Tempel. (Vide Sheet XVIII.)
7	13	- 15 27 1512 (2360), <b>Star Cluster in Canis Major.</b> Discovered by Caroline Herschel. Large and rather dense.
7	15	+ 55 28 19, <b>Lyncis.</b> A star of 5.5 mag., with a companion 6.6 mag., distance 15".
7	15	- 16 12 $R$ <b>Canis Majoris.</b> A variable of the Algol type, discovered by Sawyer, 1887. The star is usually of 6 mag., but sinks to 6.7 mag. in its period of 1 day 3 <sup>h</sup> and 16 <sup>m</sup> , the variability lasting only five hours.
7	14	+ 22 10 $\delta$ <b>Geminorum.</b> A yellowish star, 3.2 mag., with a reddish companion 8.2 mag. Distance 7", position angle 197°.
7	15	- 24 46 1513 (2362), <b>Star Cluster in Canis Major.</b> Fairly large, contains several brilliant stars. The brightest of these (30 Canis) is 6.7 mag., with several companions, one of 9 mag., distance 84", position angle 78°.

Right Ascension, 1900.		Declination, 1900.		
h.	m.	°	'	
7	24	+	13 58	1534 (2395), <b>Star Cluster in Gemini</b> . Fairly rich, contains about 40 stars of 10 mag., and several fainter ones. Lord Rosse saw in this place 70 stars of 11 mag. and under, within a space 15' diameter.
7	23	-	11 21	Σ 1097, <b>Navis</b> . A star of 6.5 mag. with four companions. The primary (A) has a companion (B) at distance 20", position angle 313°, and another companion (C) at distance 23", position angle 156°. In 1875, Dembowski discovered that A is itself double, having a companion 8 mag., d. = 08", p. = 169°. Then Burnham found another very faint star, d. = 32", p. = 43°.
7	26	-	9 34	U <b>Monocerotis</b> . A variable star, identified as such by Gould in 1872. At maximum it is 6 mag., at minimum somewhat under 7 mag. Period of variability, 46 days.
7	27	+	65 55	1541 (2404), <b>Nebula in Camelopardalis</b> . Very large, rather elongated, moderately bright, with an increase of brilliancy at the centre.
7	27	+	8 32	S <b>Canis Minoris</b> . Recognised as variable by Hind in 1856. At maximum it is sometimes 7, but often only 8 mag.; at minimum less than 11 mag. Period 330 days.
7	28	+	32 7	α <b>Geminorum</b> (Castor). One of the most beautiful double stars in the heavens, 2.7 and 3.7 mags. It can be divided with a small telescope (distance 6"). Both stars give a greenish light. The period of revolution round their common centre of gravity is about 1000 years. Near by are two stars 10 and 11 mag. Belopolsky discovered in 1896 that the principal of α is a spectroscopic double star, of which the period of revolution is 2.91 days, but no telescope can separate the components.
7	33	+	21 48	1549 (2420), <b>Star Cluster in Gemini</b> . A beautiful object discovered by W. Herschel, 19 November, 1783. The stars are numerous and densely crowded. Diameter 6'.
7	32	-	14 15	Σ 1121, <b>Navis</b> . A double star, 7 and 7.5 mags., distance 7.5". Close by is the double star Σ 1120, 6.5 and 9.5 mags., distance 19.6". This belongs to the following cluster.
7	32	-	14 16	1551 (2422), <b>Star Cluster in Navis</b> . A rich group, 15' in diameter, of small stars rather densely collected. Among them are some fairly brilliant stars. Discovered by W. Herschel, 4 February, 1875.
7	33	+	5 32	α <b>Canis Minoris</b> (Procyon). A brilliant star 1 mag. Lamont found in its neighbourhood a feeble star of 11 mag., at d. = 57", p. = 262°; several still feebler stars in closer proximity to Procyon could not be recognised by Burnham in the 36-inch instrument. On the other hand, a star of 8.5 mag. at d. = 326", p. = 84°, one of 9 mag., at d. = 384", p. = 282°, and one 6.5 mag., d. = 643", p. = 100°, have been discovered. The last-mentioned object is a double (Σ 1126) d. = 1.5". Bessel, in 1841, had recognised an irregular proper motion in Procyon, and had concluded from it that the star had a very close invisible companion. Later observations have fully confirmed Bessel's assumption, and the period of revolution has been determined to be 40 years. No one, however, up to the present has succeeded in seeing this companion through the telescope. Assuming, with Elkin, the parallax of Procyon to be 0.266", the distance separating the principal from the companion is 25 radii of the earth's orbit. The principal has five times the mass of the sun, while the mass of the companion is



Right Ascension, 1900.	Declination, 1900.
7 37	+ 23 41
7 38	+ 64 18
7 37	- 14 35
7 37	- 17 59
7 38	+ 24 39
7 39	+ 28 46
7 41	+ 33 39
7 40	- 23 38
7 43	- 11 57
7 43	+ 23 59

about the same as that of the sun. The spectrum of Procyon resembles closely that of our sun.

**$\delta$  Geminorum.** Recognised as variable by Hind in 1848. The star is of a yellowish-red colour, and at maximum is scarcely 8 mag.; at minimum it falls below 13 mag., or, in other words, disappears entirely for the average telescope. Period 294 days. The variability is not quite regular.

**$\zeta$  1127, Camelopardalis.** Primary, 6 mag., with one companion 8 mag., d. = 5 2", p. = 340°, and a second (9 mag.) d. = 11'3", p. = 175°.

1564 (2437), **Star Cluster in Navis.** Extends over 30', and is visible with a small telescope; discovered by Messier. The stars range from 7.5 to 11 mag. In this cluster W. Herschel found a faint, planetary nebula 2' in diameter, which Rosse declares to be annular.

1567 (2440), **Nebula in Navis.** A planetary nebula, somewhat blurred at the edges. It looks like a nebulous star in ordinary telescopes.

**$\kappa$  Geminorum,** 3.5 mag., with a feeble companion (11 mag.), d. = 6'4", p. = 236° (1874).

**$\beta$  Geminorum (Pollux).** A brilliant star of 1.5 mag., with several companions, all of which are very faint. W. Herschel saw one of them in 1784, South another in 1825, and Struve a third in 1836. Burnham was the first to obtain a complete view of the whole system, and he discovered that the nearest companion is itself double, 10 and 12.5 mags. respectively, but the distance is so small that the components can be separated only by a very powerful telescope. Burnham gives the following measurements of the whole system, 1899. A 1.5 mag., B 15 mag., C 11 mag., D 12 mag., E 11 mag., F 10.5 mag.

A B distance	31"	Position angle	278
A C	188"	..	72
A E	219"	..	90°
A F	243"	..	76
C D	1"	..	141
C F	58"	..	89
C E	71"	..	145

The double star C c is a very difficult object, even for the 18-inch refractor at Chicago. Burnham gives the magnitude of B as 13.5; D, 9.5; E, 9.

**$\pi$  Geminorum.** A star of 5 mag., with a very faint companion 11 mag., distance 23", position angle 212°.

1571 (2447), **Star Cluster in Navis.** Discovered by Messier, 8' in diameter, and fairly rich in stars of 8 mag. and under.

**$\delta$ , Navis,** 5.5 mag., yellowish, with a companion 7.8 mag., distance 3 4".

**$\gamma$  Geminorum.** Discovered to be variable by Hind in 1848. The star is red, and at maximum is 8.6 mag.; at minimum it is under 13.5 mag. Schoenfeld found that the increase in light becomes much slower when once the star has reached 9.5 mag. On the whole, however, it gains more rapidly than it loses in brilliancy. Period 288 days, with slight fluctuations.

Right Ascension. 1900.		Declination. 1900.		
h.	m.	°	'	
7	49	+ 22	16	<i>U Geminorum</i> . Recognised as variable by Hind in 1855, and one of the most remarkable stars of its kind. The star is generally very faint, and without essential change, but at uncertain intervals it suddenly increases to 9 mag. Schoenfeld saw it gain as much as three magnitudes in 24 hours. No certain period can be given.
7	53	+ 2	29	14, <i>Canis Minoris</i> , 5.5 mag., with two companions 7 and 8 mags., distances 76" and 112", position angles 66° and 153°.
7	55	- 10	21	1611 (2506), <i>Star Cluster in Monoceros</i> . A somewhat crowded cluster of stars, ranging from small to very faint. According to W. Herschel, who discovered the cluster 23 February, 1791, the crowded part is 5' to 6' in diameter.
7	57	+ 9	46	1617 (2510), <i>Nebula in Canis Minor</i> . Fairly faint, small (30"), elongated, with sudden increase of brilliancy at the centre.
8	2	- 8	58	Σ 1183, <i>Monocerotis</i> . A yellowish-white star of 5 mag., with a companion 8 mag., distance 31".
8	4	- 2	42	29, <i>Monocerotis</i> . A yellowish star 6 mag., with two faint companions 9.5 and 9 mags., distances 31.6" and 67", position angles 105° and 245°.
8	6	- 12	32	1630 (2539), <i>Star Cluster in Navis</i> , 20' in diameter, coarsely scattered, rich in small stars, among them a double star. Discovered by W. Herschel, 31 January, 1785.
8	7	+ 17	57	ζ <i>Cancri</i> . A triple star, consisting of a double star 5.5 and 6 mags., distance only 1", and a farther companion 5.5 mag., distance 5.4". W. Herschel saw the inner companion in 1781, but later on, neither he nor South could distinguish it. Struve was the first to find it again in 1826. It seems, from observations made by M. Seeliger and M. Harzer, that a dark body is a companion of the nearest satellite.
8	7	- 12	38	1632 (2542), <i>Navis</i> . A nebulous star, 5.6 mag.
8	9	- 5	30	1637 (2548), <i>Star Cluster in Monoceros</i> . Fairly large, and crowded with stars of 9 mag., also a pretty double star.
8	11	+ 12	2	<i>R Cancri</i> . Discovered to be variable by Schwed in 1829. The star is yellowish-red, at maximum 6.5, at minimum 12 mag. The period is 353 days, and seems to be gradually lengthening.
8	16	+ 17	36	ν <i>Cancri</i> . Found to be variable by Auwers in 1870. At maximum it is under 7 mag., at minimum less than 12 mag. The period is nearly 272 days.
8	21	+ 27	16	φ <sup>2</sup> <i>Cancri</i> , 6 mag., with a companion 6.5 mag., distance 5"; divided long ago by Chr. Mayer.
8	21	+ 24	52	ν <sup>1</sup> <i>Cancri</i> , 6 mag., with a companion 7 mag., distance 6".
8	26	+ 18	27	θ <i>Cancri</i> . A yellowish star 5.5 mag., with a companion 9 mag., distance 61".
8	31	+ 6	58	Σ 1245, <i>Hydrae</i> . A star 6.5 mag., with a somewhat fainter companion, distance 10.3", position angle 25°. No change in position has been noticed during the last 60 years.
8	34	+ 20	20	1681 (2632), <i>Star Cluster in Cancer</i> . Visible to the naked eye; the so-called "Præsepe." With a telescope this cluster, which is very rich in stars, can be easily resolved. Gould has photographed and measured it.
8	38	+ 19	24	S <i>Cancri</i> . Found to be variable by Hind in 1848. This somewhat

h.	m.	Right Ascension, 1900.	Declination, 1900.	
				yellowish variable belongs to the Algol type. At maximum it is 8.2 at minimum 9.8 mag. Period 9 days 11.38. The decrease in brilliancy lasts $8\frac{1}{2}^h$ , the increase $13^h$ .
8	41	+ 29	8	$\iota$ <b>Canceri</b> , 4.5 mag., with a companion 6.5 mag., distance 31", position angle 307°. Discovered to be double by Herschel, 8 February 1782.
3	43	+ 78	36	1691 (2655), <b>Nebula in Camelopardalis</b> . Fairly bright, and tolerably large, with an increase of brilliancy towards the centre, at first gradual, then sudden.
3	42	+ 6	47	$\epsilon$ <b>Hydrae</b> . A yellowish star, 3.8 mag., with a blueish companion 7.8 mag., distance 3.5". Holden, with the great refractor at Washington, saw another very faint companion, d. = 20", p. = 192°. Schiaparelli finds the primary to be itself double, 4.5 and 5 mags., d. = 0.2".
8	46	+ 51	41	1711 (2681), <b>Nebula in Ursa Major</b> . Fairly brilliant, large, brighter at first gradually, then suddenly towards the centre, where is a star 10 mag.
8	46	+ 12	11	1712 (2682), <b>Star Cluster in Cancer</b> . Discovered by Messier, and described as a star cluster with nebula. Herschel resolved the whole into stars of from 8.5 to 12 or 13 mag. They number over 200. There does not seem to be any common centre to the cluster. A beautiful object.
8	47	+ 33	48	1713 (2683), <b>Nebula in Cancer</b> . A very faint nebula, followed by a star of 8.5 mag. Rather more brilliant towards the centre.
8	47	- 6	48	15, <b>Hydrae</b> . This star, 6 mag., has (as discovered by Herschel) a companion 7 mag., at distance 45", position angle 358°. Burnham divided the primary into two points of light at 0.9" distance, and found an additional companion at distance 51", position angle 53°.
8	43	+ 3	27	$S$ <b>Hydrae</b> . Variable, discovered by Hind in 1848. The star is a yellowish-red. At maximum it is sometimes 7.5, though often only 8.5 mag., at minimum it is under 12 mag. Period 257 days.
8	48	+ 30	58	$\sigma^3$ <b>Canceri</b> , 6 mag., with a companion 6.5 mag., distance 1.5".
8	51	- 8	46	$T$ <b>Hydrae</b> . Found to be variable by Hind in 1851. At maximum seems to be 7 mag., though often only 8 mag.; at minimum it is under 13 mag. Period 289 days.
8	52	+ 48	27	$\iota$ <b>Ursa Majoris</b> , 3 mag., with a companion 10 mag., distance 10", position angle 353°.
8	53	+ 12	15	$\alpha$ <b>Canceri</b> . A star of 4.5 mag., with a very faint companion 12 mag., distance 11.4", position angle 325°.
8	55	+ 32	39	66, <b>Canceri</b> . A white star of 5.5 mag., with a companion 8 mag., distance 4.3", position angle 137°.
8	56	+ 28	18	67, <b>Canceri</b> . A star of 6.5 mag., with a remote satellite. It is at distance 103", position angle 323°.
9	0	+ 60	53	1750 (2742), <b>Nebula in Ursa Major</b> . Rather faint, but extensive. Rosse's telescope shows this object as a formless, nebulous mass of an uneven character.
2	2	+ 67	32	$\sigma^2$ <b>Ursae Majoris</b> , 5 mag., and somewhat greenish, with a companion 8 mag., distance 2", position angle 224° (1889).
9	2	+ 23	23	$\Sigma$ 1311, <b>Canceri</b> . A star of 7 mag., with a companion of equal brilliancy, distance 7".

Right Ascension. 1900.		Declination. 1900.	
h.	m.		
9	4	+ 60 27	1765 (2768), <b>Nebula in Ursa Major</b> . Faint, fairly large, with a sudden increase of brightness towards the centre, with a kind of nucleus.
9	9	+ 2 45	$\theta$ <b>Hydrae</b> , 4.5 mag., with a companion 11 mag., distance 53", position angle 175°.
9	10	+ 69 37	1781 (2787), <b>Nebula in Ursa Major</b> . Fairly brilliant and large, with an increase of brightness towards the centre, where there is a star. Herschel thought it resolvable.
9	12	+ 35 47	$\Sigma$ 1333, <b>Lyncis</b> , 6.5 mag., with a companion 7 mag., distance 1.4".
9	13	+ 37 14	38 <b>Lyncis</b> . A star of 4 mag., with a companion 6.7 mag., distance 3", position angle 237°.
9	14	+ 34 10	1811 (2830), <b>Nebula in Lynx</b> . Fairly brilliant, of moderate size and considerably brighter on its succeeding side. To the south are 3 small stars.
9	15	+ 51 24	1823 (2841), <b>Nebula in Ursa Major</b> . Fairly brilliant, 6' in diameter. In Rosse's telescope it shows some resemblance to the nebula in Andromeda.
9	16	+ 50 57	39, <b>Lyncis</b> , 6.5 mag., with a faint companion 8.5 mag., distance 6", position angle 319°.
9	22	+ 46 2	41, <b>Lyncis</b> , 6 mag., with companion 8 mag., distance 82", position angle 162°.
9	23	+ 9 30	$\omega$ <b>Leonis</b> . A difficult double star 6 and 7 mags., both yellowish. The distance is, at times, so small that even the most powerful telescopes show only an elongated star. Hall found (1891): distance 0.7", position angle 101°. The motion of the companion seems to indicate 110 years as the period of revolution.
9	24	+ 63 30	23, <b>Ursae Majoris</b> , 3.8 mag., with a companion 9 mag., distance 23", position angle 272°.
9	24	+ 2 19	$\tau^1$ <b>Hydrae</b> , 5.5 mag., with a satellite 8.5 mag., distance 65", position angle 3°.
9	26	+ 52 8	$\zeta$ <b>Ursae Majoris</b> , 3 mag., with an extremely feeble companion (14 mag.), discovered by Burnham, at distance 5", position 78°. Belopolsky discovered in 1899 that the principal also is a spectroscopic double star, with a period of revolution of 5 to 7 days.
9	27	+ 21 56	1861, 1863 (2903, 2905), <b>Nebula in Leo</b> . Large and brilliant, appearing as a double nebula in powerful telescopes; with a very strong instrument a third nebula is visible. According to Tempel, the whole is a large, spindle-shaped nebula, at least 15' long, with 3 nodes, of which the southernmost is fainter than the northernmost, and the middle one is of a stellar nature and very brilliant. The spindle shape is ill-defined towards the north. According to Rosse, the whole constitutes a spiral nebula.
9	27	+ 10 10	6, <b>Leonis</b> , 6 mag., somewhat reddish, with a companion 9 mag., distance 38.8", position angle 74.3°. The position of the companion has not altered since Herschel's time.
9	30	+ 14 50	7, <b>Leonis</b> . A star of 6 mag., with a companion 8 mag., distance 42", position angle 79.5°.
9	36	+ 10 21	$\circ$ <b>Leonis</b> . A star of 3.5 mag., which from photographic and spectroscopic investigations at the Lick Observatory turns out to be a spectroscopic double, with a period of revolution of 14.5 days.

Right Ascension 1900.	Declination 1900.	
9 40	+ 34	58 <b><math>R</math> Leonis Minoris.</b> A variable star, identified as such by Schoenfeld in 1863. At maximum it is 6 mag., sometimes only 7.5 mag.; at minimum it is under 13 mag. Period 370 days.
9 41	+ 72	45 1909 (2985), <b>Nebula in Ursa Major.</b> About one minute in extent, elongated, fairly brilliant, with a nucleus in the centre.
9 42	+ 11	54 <b><math>R</math> Leonis.</b> A variable star, identified as such by Koch in 1782, of a deep red colour, and gives a peculiar spectrum. At maximum it is 5.20 to 6.7, at minimum 10 mag. Period 313 days.
9 45	+ 54	32 <b><math>\phi</math> Ursae Majoris.</b> An exceedingly close double star, 5 and 5.5 magnitudes, distance only 0.2". It can only occasionally be divided even with the best powerful telescope.
9 47	+ 69	32 1949, 1950 (3031, 3034), <b>Nebula in Ursa Major.</b> Two nebulae discovered by Bode at 30' distance from one another. The preceding one, 15' long, is the more brilliant of the two, and has a nucleus like a star of 8.5 mag.; the succeeding one is smaller and fainter.
9 49	+ 5	25 <b><math>\theta</math> Sextantis.</b> A reddish star, 7 mag., with a companion 9 mag., distance 52", position angle 292°.
10 0	- 7	13 2008 (3115), <b>Nebula in Sextans.</b> Discovered by Herschel; fairly brilliant, with an increase of light towards the centre which resembles a star of 9.5 mag. Very faint when viewed with a small telescope.
10 3	+ 12	27 <b><math>\alpha</math> Leonis (Regulus).</b> A brilliant star with a beautiful spectrum. At distance 3' is a star 8.5 mag., which has the same proper motion as $\alpha$ . There is an extremely faint companion at distance 3.3", position angle 88.5°.
10 8	+ 73	54 2024 (3147), <b>Nebula in Draco.</b> Fairly brilliant, large, round, with an increase of brilliancy towards the centre, at first gradual, then abrupt.
10 9	+ 3	58 2038 (3166), <b>Nebula in Sextans.</b> Fairly brilliant, small, round, with a sudden increase of brightness towards the centre. It is followed in the field of vision by another fainter nebula, not noticed by W. Herschel.
10 11	+ 29	21 <b><math>\gamma</math> Leonis.</b> A golden-yellowish star, 2 mag., with a greenish-red companion of 3.5 mag., distance 3 6". According to Struve, the most beautiful double star in the northern heavens. Singularly enough, W. Herschel gives both stars as white. According to the photo-spectroscopic measurements of Vogel, which have been fully confirmed by Belopolsky, this double star is approaching our sun at the rate of 225 miles per second.
10 20	- 18	8 2102 (3342), <b>Nebula in Hydra.</b> A planetary nebula nearly 1' in diameter, fairly brilliant. W. Herschel saw no traces of a stary nature in it. To Secchi, on the other hand, it appeared quite differently; within a circular nebula he distinguished two star clusters, which are bound together by a shining ring composed of two semicircles of stars. There is also a star in the nebulous space at the centre. Tempel thinks the nebula very wonderful. He considers it to be a small, oval, brilliant disc of light surrounded by sharply defined, densely collected stars. In the southern central and northern portions shine out a few stars of greater brilliancy. "These," says Tempel, "like living, pulsating points, form a striking contrast to the dark background, which is totally free from nebula."
10 22	+ 29	1 2104 (3245), <b>Nebula in Leo Minor.</b> Fairly brilliant, elliptical in shape, with a kind of brilliant nucleus in the centre.

Right Ascension. 1900.		Declination. 1900.			
h.	m.	°	'		
10	30	+	9	10	49, <b>Leonis</b> , 6 mag., with a companion 9 mag., at distance 2.4", the position of which does not seem to alter.
10	32	+	54	1	2158 (3310), <b>Nebula in Ursa Major</b> . Planetary, with blurred edges, containing 2 stars of 10 mag.
10	38	+	69	18	<b>R Ursae Majoris</b> . A variable star, recognised by Pogson in 1853. At maximum it is sometimes 6, though often only 8 mag., at minimum 13 mag. Period 302 days.
10	38	+	25	27	2178 (3344), <b>Nebula in Leo Minor</b> . Fairly bright, with an increase of brilliancy towards the centre. There is a star surrounded by the nebula. Rosse sees spiral coils round a luminous centre.
10	39	+	12	14	2184 (3351), <b>Nebula in Leo</b> . Discovered by Méchain, and described as a very faint starless nebula; it really is fairly brilliant, large, and round, brighter at the centre, with a nucleus resembling a star of 10 mag.
10	38	+	5	16	35, <b>Sextantis</b> , 6 mag., with a companion 7 mag., distance 7", position angle 240°.
10	42	+	12	21	2194 (3368), <b>Nebula in Leo</b> . Very brilliant, irregularly round in shape, with a nucleus, probably resolvable.
10	43	+	13	6	2203, 2207 (3379, 3384), <b>Nebula in Leo</b> . Double, fairly brilliant and large; the second nebula has a nucleus like a star of 9.5 mag. A third very faint nebula follows and forms a triangle with the other two.
10	45	-	8	22	41, <b>Sextantis</b> . Triple. The primary is 5, the farther companion 9, the nearer 11 mag. Burnham gives (1879) the following measurements: A B, d. = 26.9", p. = 304°; A C, d. = 233", p. = 72°. The nearest companion is not visible except in a powerful telescope.
10	48	+	57	39	2245 (3440), <b>Nebula in Ursa Major</b> . Fairly brilliant, of moderate size, and irregularly circular in shape, gradually brighter towards the centre. Followed to the northward by a star 10 mag., distance 2'.
10	50	+	25	17	54, <b>Leonis</b> . A star 4.5 mag., with a blueish companion 7 mag., distance 6".
10	54	+	59	27	Σ 1495, <b>Ursae Majoris</b> , 6 mag., yellowish, with a companion 8 mag., distance 35".
10	55	+	29	31	2274 (3486), <b>Nebula in Leo Minor</b> . Large, brilliant, supposed by Herschel to be a globular star cluster at an immeasurable distance.
10	56	+	4	15	2279 (3494), <b>Nebula in Leo</b> . According to Tempel, this is a large and thick spindle-shaped nebula 5' long by 1.5' broad, with 3 distinct nebula nodes in its major axis. In all of these faint stars are visible. About 6' north of the middle node, Tempel repeatedly observed a small nebula.
10	58	+	62	18	<b>α Ursae Majoris</b> . Seen as a double star by the large telescope at Mount Hamilton, d. = 0.9". Spectrum of the IIa. type of Vogel, departing widely from the solar spectrum.
10	57	+	56	56	<b>β Ursae Majoris</b> . A greenish-white star, 2.3 mag., with a very faint companion, distance 245", position angle 354°.
10	59	+	28	34	2287 (3512), <b>Nebula in Leo Minor</b> . Fairly brilliant, with what looks like a nucleus in the centre. According to Herschel, this nebula is really a resolvable star cluster.
11	1	+	0	30	2301 (3521), <b>Nebula in Leo</b> . Fairly large, oval, with a star-shaped nucleus. Several stars follow it.
11	6	+	56	13	2318 (3556), <b>Nebula in Ursa Major</b> . Discovered by W. Herschel,

Right Ascension, 1900.		Declination, 1900.		
h.	m.	°	'	
				7 April, 1780, elongated, fairly brilliant, with a star in the centre. According to Herschel, however, the latter is merely accidentally projected on the nebula.
11	9	+ 55	34	2343 (3587), <b>Nebula in Ursa Major</b> . Large, planetary, discovered by Méchain in 1781. According to J. Herschel, it is 2' 40" in diameter, and of uniform brilliancy throughout. Rosse sees two dark openings in the nebula with a star in each. Huggins considers it to be a mass of incandescent gas. Like every other planetary nebula, it gives a spectrum of bright lines showing it to be a globular mass of glowing gases.
11	10	+ 53	19	Σ 1520, <b>Ursae Majoris</b> . A star of 6.5 mag., with a companion 8 mag., distance 13".
11	10	+ 18	39	2352 (3599), <b>Nebula in Leo</b> . A faint nebula, considered by d'Arrest to be variable. Schoenfeld found it to be brilliant in 1861, but in 1863 it was occasionally invisible. At present it is very faint.
11	12	+ 59	20	2360 (3610), <b>Nebula in Ursa Major</b> . Fairly brilliant, but small, with a nucleus.
11	13	+ 58	33	2362 (3613), <b>Nebula in Ursa Major</b> . Fairly brilliant, of moderate size, much brighter towards the centre, with what seems to be a nucleus.
11	13	+ 32	6	ξ <b>Ursae Majoris</b> . A yellowish star, 4 mag., with a greyish-white companion 5 mag. This latter moves with great rapidity, its period of revolution being only 61 years. Distance in 1892, 1.6".
11	13	+ 33	38	ν <b>Ursae Majoris</b> . Yellowish, 4 mag., with a very faint companion 10.5 mag., distance 7", position angle 147°.
11	15	+ 13	32	2373, 2377 (3623, 3627), <b>Nebulae in Leo</b> . Double, fairly brilliant, the succeeding one being brighter. The nebulae are spiral-shaped with central nuclei which seem to be surrounded by elliptical rings. The nebula 2373 is 7' long by 2' broad, the other 5' long by 2½' broad.
11	19	+ 11	5	ε <b>Leonis</b> . A yellowish star 4 mag., with a blueish companion 7 mag., d. = 2.8", p. = 65°.
11	20	- 17	8	γ <b>Crateris</b> . A star of 4 mag., with a companion, discovered by W. Herschel, of 10 mag., at distance 5", position angle 98° (1877).
11	23	+ 3	25	τ <b>Leonis</b> , 5 mag., yellowish, with a white companion 7 mag., distance 94". Easily observed.
11	24	+ 39	53	57, <b>Ursae Majoris</b> , 5 mag., with a companion 8 mag., distance 5.4", position angle 7°.
11	27	- 28	43	<b>In Hydra</b> . Two stars, 5.5 and 6.5 mags., distance 8.7".
11	27	- 14	56	88, <b>Leonis</b> . Yellowish, 6 mag., with a faint companion 8 mag., distance 15", position angle 320°.
11	30	+ 17	21	90, <b>Leonis</b> . A star of 6 mag., with a companion 7 mag., distance 3", position angle 209°. At distance 63", position angle 234°, is a star of 9.5 mag.
11	34	+ 45	40	Σ 1561, <b>Ursae Majoris</b> , 6 mag., with a companion 8 mag., distance 10".
11	43	+ 20	47	93, <b>Leonis</b> , 5 mag., with a companion 8.4 mag., distance 7.4", position angle 356°.
11	44	+ 15	8	β <b>Leonis</b> , 2 mag., with a very beautiful spectrum, has two faint stars in its vicinity. Burnham gives the following magnitudes and positions: B 15.5 mag.; C 15 mag.; A B, d. = 40", p. = 346°; A C, d. = 79", p. = 351°.

Right Ascension. 1900.		Declination. 1900.			
h.	m.	+	'		
11	38	+	38	34	<b>Star in Ursa Major</b> of 8 mag. Of all the stars visible in our northern heavens this has the greatest apparent proper motion, amounting to 7.05'' yearly.
11	48	+	37	32	2600 (3941), <b>Nebula in Ursa Major</b> . A fairly brilliant nebula 3' to 4' in diameter, with an increase of density towards the centre.
11	50	+	47	2	65, <b>Ursae Majoris</b> , 5.6 mag., with a blueish companion 8.5 mag., distance 3.7''. There is also a star of 6.5 mag. at distance 114''.
11	52	+	53	55	2635 (3992), <b>Nebula in Ursa Major</b> . A faint nebulous appearance between two stars, 7' long by 4' broad, according to Herschel. Tempel estimates it as at the most only 2½' in diameter, and says he sees 3 brilliant stars round its speckled centre.
11	54	+	51	31	2660 (4026), <b>Nebula in Ursa Major</b> . Discovered by W. Herschel, 12 April, 1789, brilliant, 5' long by 1½' broad, increasing in brightness towards the centre, with a brilliant nucleus.
11	58	+	45	5	2680 (4051), <b>Nebula in Ursa Major</b> . Brilliant, fairly large, with a sudden increase of brightness towards the centre. Rosse finds it to be of spiral structure.
11	59	+	22	1	2, <b>Comae Berenices</b> , 6 mag, with a companion 7.5 mag, d. = 4'', p. = 240°.
12	2	+	43	37	2723 (4111), <b>Nebula in Canes Venatici</b> . Fairly bright, elongated, with a very brilliant nucleus. Discovered by Herschel, 14 January, 1788.
12	5	+	19	6	2752 (4147), <b>Star Cluster in Coma Berenices</b> . Of moderate size, very brilliant, globular; the stars are more densely collected towards the centre.
12	5	+	40	33	Σ 1606, <b>Canum Venaticorum</b> . A star of 6 mag., with a companion 7 mag., distance 1.4''.
12	9	+	15	27	2786 (4192), <b>Nebula in Coma Berenices</b> . A large pale nebula 15' long, with a star-like centre. Discovered by Méchain, 5 March, 1781. Tempel found another small round nebula to the southward.
12	11	+	41	13	2, <b>Canum Venaticorum</b> . A reddish star 5.5 mag., with a blueish companion 8 mag., distance 11.4'', position angle 260°. The colours are fairly decided.
12	11	+	13	42	2806 (4216), <b>Nebula in Virgo</b> , 9' to 10' long, brighter in the centre. Discovered by Herschel, 8 April, 1784. It is spindle-shaped, and Tempel saw two accompanying nebulae. The one preceding it to the south is 5' long, oval in shape, and has 3 brilliant nodes; it is situated towards the centre of the principal nebula: 35°—6½'. To the south there follows a small star 10 to 11 mag. The companion nebula on the north, which follows it, is round, 1' in diameter, and very faint.
12	13	-	3	23	Σ 1627, <b>Virginis</b> , 6 mag., with a companion 6.5 mag., d=20'', p.=196°.
12	14	+	14	59	2838 (4254), <b>Nebula in Coma Berenices</b> . Discovered by Méchain, 15 March, 1781, and described as a starless nebula. Vogel observed it with the 8-inch refractor at Leipsic, and found it to be large, brilliant, and apparently resolvable at the centre, where there are two bright starry points. With magnifying power 192, a spiral arrangement was visible.
12	14	+	47	52	2841 (4258), <b>Nebula in Ursa Major</b> . Brilliant, with a nucleus, fairly large. Discovered by Herschel. No trace of resolvability. A continuous spectrum shows that this nebula is a very distinct star cluster.



Right Ascension 1900.		Declination 1900.			
<i>h.</i>	<i>m.</i>	<i>°</i>	<i>'</i>		
12	14	-	18	42	<i>R</i> <b>Corvi</b> . Recognised as variable by Karlinski in 1867. At maximum it generally reaches 7 mag.; at minimum it is 11 mag. Period 312 days.
12	17	+	5	2	2878 (4303), <b>Nebula in Virgo</b> . Discovered by Messier, 1779. A very faint nebula, in which Herschel recognised two nuclei. According to Ross it is a spiral nebula.
12	18	+	26	24	12 <b>Comae Berenices</b> , 4.5 mag., with a companion 8.5 mag. Distance 66", position angle 169°.
12	18	+	16	23	2890 (4321), <b>Nebula in Coma Berenices</b> . Discovered by Méchain, 15 March, 1781, fairly large, round and faint, with a spiral arrangement.
12	20	+	13	27	2930 (4374), <b>Nebula in Virgo</b> . A fairly brilliant, circular nebula, which suddenly increases in brightness towards the centre. Discovered by Messier.
12	20	+	18	45	2946 (4382), <b>Nebula in Coma Berenices</b> . Discovered by Méchain, and described as faint and starless. Herschel calls it brilliant. A star 9 mag. follows 2' southward.
12	21	+	13	30	2961 (4406), <b>Nebula in Virgo</b> . Comes into sight at the same moment as the nebula 2930, brilliant, round, with nucleus in the centre. Also discovered by Messier; 3' to 4' in diameter.
12	22	+	31	46	2972 (4414), <b>Nebula in Canes Venatici</b> . Fairly brilliant and large, increasing in brightness towards the centre, at which there is a star.
12	23	+	44	39	3002 (4449), <b>Nebula in Canes Venatici</b> . Fairly brilliant and large; was resolved into stars by Herschel's great telescope.
12	24	+	26	29	17, <b>Comae Berenices</b> . A star of 5 mag., with a companion 6 mag., distance 1.45". Burnham has divided the companion into two stars of 4 mag. and 14 mag. respectively; distance 1.8".
12	25	+	8	33	3021 (4472), <b>Nebula in Virgo</b> . Discovered by Oriani in 1771, and described by Messier as a nebula, which can be seen, but with difficulty, in a 3½-foot telescope. On right and left is a star of 6 mag. An insignificant object in small instruments.
12	26	+	42	12	3041 (4490), <b>Nebula in Canes Venatici</b> . A double nebula. The preceding one is faint, fairly small, and irregular in shape; the other, which follows 3' to the south, is larger and more brilliant. In Herschel's telescope it was partly resolvable into stars.
12	25	-	15	57	δ <b>Corvi</b> , 2.5 mag., with a companion 8 mag.; distance 24", position angle 211°.
12	26	-	12	57	3035 (4486), <b>Nebula in Virgo</b> . Discovered by Messier; of moderate brilliancy, round and large, brightest in the centre.
12	26	+	26	20	3043 (4494), <b>Nebula in Coma Berenices</b> . Faint, round, with nucleus.
12	27	+	15	58	3049 (4501), <b>Nebula in Virgo</b> . Discovered by Messier in 1781, and described as a starless nebula, situated between two stars of 6 mag., which come into view at the same moment. It is elliptical and the northern part is brighter than the southern. Lassell and Vogel have made maps of this nebula.
12	29	+	8	15	3075 (4526), <b>Nebula in Virgo</b> . Of moderate brilliancy, with a sudden increase of brightness towards the centre. Preceded by a star of 9 mag.
12	30	+	28	56	24, <b>Comae Berenices</b> , 5 mag. and yellow, with a blueish companion 6 mag.; distance 20", position angle 271°.

Right Ascension, 1900.		Declination, 1900.		
h.	m.	°	'	
12	31	+ 13	7	3097 (4552), <b>Nebula in Virgo</b> . Discovered as a very faint starless nebula by Messier; it is round and brighter towards the centre. Vogel observed it with the Leipsic Refractor, and describes it as very brilliant, 2' in extent, suddenly denser at the centre, with a brilliant nucleus.
12	31	+ 28	31	3101 (4559), <b>Nebula in Coma Berenices</b> . Fairly bright and large, gradually more brilliant towards the centre. Three stars follow it.
12	31	+ 11	59	3105 (4568), <b>Nebula in Virgo</b> . A faint, double nebula, coming into view at the same moment as two others still fainter. Tempel has made a map of the whole, including the neighbouring stars.
12	31	+ 26	32	3106 (4565), <b>Nebula in Coma Berenices</b> . A somewhat faint nebula, very long (15') and 3' to 4' in breadth, brighter towards the centre, with a nucleus like a star of 10 mag. Preceded by four faint stars.
12	32	+ 60	2	<i>T Ursae Majoris</i> . Recognised as variable at Bonn in 1860. At maximum it is sometimes 6, though often only 8 mag.; at minimum under 13. Period 257 days. The star is of a reddish-yellow colour.
12	33	+ 12	22	3121 (4579), <b>Nebula in Virgo</b> . Discovered by Messier in 1779, and described as a very faint nebula. John Herschel calls it brilliant, large, irregularly round, bright towards the centre, and probably capable of being resolved into stars.
12	33	+ 7	32	<i>R Virginis</i> . A reddish-yellow star, whose variability was recognised by Harding in 1809. At maximum it is 6.5 to 8 mag.; at minimum 10 to 11 mag. Period 145 days.
12	34	- 26	12	3128 (4590), <b>Nebula in Hydra</b> . Discovered by Messier in 1780, and described by him as a very faint starless nebula not easy to distinguish. Near it is a star of 6 mag. In 1786 the nebula was resolved into separate stars by F. W. Herschel's 20-foot reflector, these being very densely collected towards the centre. The cluster is 4' long by 3' broad.
12	35	- 11	4	3132 (4594), <b>Nebula in Virgo</b> . An elongated, elliptical nebula, brighter at the centre. With a low magnifying power, several stars come into view at the same time as the nebula.
12	36	- 12	28	$\Sigma$ 1669, <b>Virginis</b> . A star of 6 mag., with a companion of nearly equal magnitude. Distance 5.8".
12	37	- 0	54	$\gamma$ <b>Virginis</b> . A yellowish star 3 mag., with a somewhat fainter companion. This latter is at present easy to observe (d. = 5.6", p. = 153°, 1892): its period of revolution is 180 years. There is also another faint star (11.5 mag., d. = 53", p. = 159°).
12	37	+ 33	6	3165 (4631), <b>Nebula in Canes Venatici</b> . A strip of nebula 12' long, but faint, with a small star in the centre.
12	38	+ 2	32	3176 (4643), <b>Nebula in Virgo</b> . Somewhat faint, starless, brightest at the centre.
12	39	+ 12	6	3182 (4649), <b>Nebula in Virgo</b> . Discovered by Messier, who, however, did not see a faint nebula which precedes it. Somewhat faint. As seen with the Leipsic refractor, it seems capable of being resolved into stars.
12	40	+ 61	38	<i>S Ursae Majoris</i> . Of a reddish-yellow, recognised as variable by Pogson in 1853. The changes of brilliancy are somewhat irregular. At maximum it is 7, at minimum 10, sometimes 11 mag. The period of 226 days is, apparently, slowly increasing.

Right Ascension. 1900.	Declination 1900.	
h. m.	°	
12 40	+ 14 55	Σ 1678, <b>Comae Berenices</b> , 6 mag., with a companion 7 mag., distance 33".
12 43	- 5 15	3227 (4697), <b>Nebula in Virgo</b> . Fairly large, but not very brilliant increasing in brilliancy towards the centre, with a kind of nucleus, which Herschel thought resolvable into stars.
12 46	- 9 48	Σ 1682, <b>Virginis</b> , 6.5 mag., yellowish, with a reddish companion 9 mag., d. = 34", p. = 309".
12 46	+ 41 40	3258 (4736), <b>Nebula in Canes Venatici</b> . Discovered by Méchain, and described by him as a starless nebula, of fair brilliancy, 2.5' in diameter, with brilliant centre. Several stars come into view at the same moment as this nebula, one of them a double star, which follows it. According to Rosse it is of a spiral form.
12 48	+ 6 12	<i>U</i> <b>Virginis</b> . Recognised as variable by Harding in 1831. The star is reddish, and at maximum 8 mag., at minimum 13 mag. Period nearly 207 days.
12 48	+ 11 46	3278 (4762), <b>Nebula in Virgo</b> . Two faint nebulae at 8' to 10' distance from one another. Discovered by W. Herschel on 15 March, 1784. The preceding nebula is long and thin, and has an elongated nucleus.
12 48	+ 21 47	35, <b>Comae Berenices</b> , 5 mag. and yellowish, with a blueish companion 8 mag., distance 1 2", and a second companion 9 mag., d. = 28.5", p. = 124".
12 50	- 12 0	3293 (4792), <b>Nebulae in Virgo</b> . Double, faint, with other small, faint nebulae in the vicinity. Tempel has made a map of this group of nebulae.
12 51	+ 38 52	12, <b>Canum Venaticorum</b> . The brightest star in the constellation, and known by the name of "Cor Caroli." The star is 3 mag., and has a companion 6 mag. at distance 20", in whose position no change has yet been observed.
12 52	+ 54 38	Σ 1695, <b>Ursae Majoris</b> , 6 mag., with a companion 8 mag., d. = 3", p. = 289".
12 54	+ 14 43	3342 (4866), <b>Nebula in Coma Berenices</b> . A brilliant nebula of fair size with a core-like density at the centre. There is a small star in this nebula.
12 57	+ 11 30	ε <b>Virginis</b> . A star of 4 mag., with a very faint companion (12 mag.), d. = 241", p. = 120".
13 5	+ 18 4	42, <b>Comae Berenices</b> . Two stars of 6 mag., but whose distance is so small that they may be considered one of the most difficult of double stars. Struve, who discovered their duplex character in 1827, could generally only distinguish an elongated star, actual division being only occasionally possible. Dembowski too, in 1863, saw only an elongated star; Burnham, however, in 1879, measured the distance as 0.67", position angle 192°. Since 1882 the division has been easier than heretofore, but still requires an instrument of the first class. The period of revolution is 257 years.
13 6	+ 39 9	15, 17, <b>Canum Venaticorum</b> . Two stars of nearly equal brilliancy, 5.5 mag. The distance is 4' 30", yet they cannot be divided without a telescope.
13 5	- 5 0	θ <b>Virginis</b> . Triple, 15, 9, and 10 mag. The nearer companion, d. = 7.1", p. = 344"; the farther and fainter, d. = 1.1", p. = 29".

Right Ascension. 1900.		Declination. 1900.		
h.	m.	°	'	
13	6	+ 37	36	3437 (5005), <b>Nebula in Canes Venatici</b> . A fairly brilliant nebula, 6' long by 1·5' broad, discovered by Herschel 1 May, 1785. Increases abruptly in brilliancy towards the centre, where it has what looks like a nucleus.
13	8	+ 18	42	3453 (5024), <b>Star Cluster in Coma Berenices</b> . Discovered by Messier in 1777, and described as a starless nebula. In reality it is a star cluster in which, according to Rosse, 4 or 5 condensations are visible. A very beautiful object.
13	11	+ 42	34	3474 (5055), <b>Nebula in Canes Venatici</b> . Discovered by Méchain in 1779, and described as a faint and starless nebula. According to Herschel, it is 10' long by 4', with a bright nucleus. Huggins finds that it gives a continuous spectrum, which proves it to be a star cluster at an immeasurable distance.
13	20	- 10	38	<i>a</i> <b>Virginis (Spica)</b> . Professor Vogel announced, 1890, that this consists of two close stars (companion obscure) of equal mass, revolving round their common centre of gravity in 4·013 days.
13	20	+ 55	27	$\zeta$ <b>Ursae Majoris</b> , 2 mag., and greenish-white, with a companion 4·5 mag., distance 14". One of the most beautiful double stars in the heavens. At 11' 47" distance from $\zeta$ is <i>g</i> or Alkor, and, in addition, a star 8 mag., distance 8·5', together with several fainter ones. Pickering found in 1889 that the line <i>k</i> in the photographic spectrum of this star appeared to be subject to rapid changes, becoming feebler and doubled. He concluded rightly from this that $\zeta$ is an irresolvable double star, its companion having a period of revolution of 104 days. The components are at a distance from each other of at least 143 millions of miles, but are not, however, separable in the telescope.
13	21	- 2	52	<i>W</i> <b>Virginis</b> . Recognised as variable by Schoenfeld in 1866. At maximum it is 9 mag., and at minimum 10 to 10·4 mag. Period 17·3 days. The change of brilliancy is very uniform.
13	24	- 22	46	<i>R</i> <b>Hydrae</b> . A deep red star, recognised as variable by Maraldi in 1704. At maximum it is 3·5 to 5·5 mag., at minimum 10 mag. Period 425 days; formerly it seems to have been longer.
13	26	+ 47	43	3572 (5194), <b>Nebula in Canes Venatici</b> . Discovered by Messier in 1773, and described as a faint, starless nebula, but double, each portion being bright in the centre, and 4½' in diameter. W. Herschel describes it as a brilliant, circular nebula, surrounded by a faint nebular halo and accompanied by a second nebula. J. Herschel's description and drawing were also wrong. Rosse's telescope showed the true structure of the nebula, <i>i.e.</i> a spiral mass which seems to be wound round a brilliant centre ( <i>vide</i> Sheet XVI.). These spiral coils have also been clearly distinguished and mapped out by Vogel, with the help of the Leipsic 8-inch refractor. It would thus seem that we have here a mass of a really nebulous character coiling in vast convolutions round an enormous centre, yet spectrum analysis contradicts this theory. The nebula has a continuous spectrum similar to that of the stars, and without any bright lines, which are never absent from the spectra of true incandescent nebulae. Mr. Roberts' photograph, taken 1889, in four hours' exposure, gives clearer details of the arrangement of this nebula.

Right Ascension 1900	Declination 1900	
13 28	- 6 41	$\delta$ <b>Virginis</b> . Recognised as variable by Hind in 1827, the change of brilliancy is somewhat irregular. At maximum the star is 6 mag., sometimes only 8 mag.; at minimum under 12 mag. Period 376 days.
13 33	- 17 22	3614 (5247), <b>Nebula in Virgo</b> . Faint; according to Lassell, a spiral with two arms.
13 33	+ 36 48	25, <b>Canum Venaticorum</b> . A star of 5.5 mag., with a companion 7.5 mag., distance (when discovered by Struve in 1829) 1.05". Burnham gave in 1892 d. = 1". The distance is now increasing again.
13 33	+ 9 24	3615 (5248), <b>Nebula in Virgo</b> . Brilliant, 9' to 10' in length, with two nebulous nodes in the centre. There is one star to the south of it, and several fainter ones to the north. Tempel discovered some very faint nebulae in its vicinity.
13 35	+ 20 34	1, <b>Bootis</b> , ( $\Sigma$ 1772). A star of 6 mag., with a faint companion 9 mag., distance 4.8".
13 38	+ 4 3	84, <b>Virginis</b> , 6 mag., with a companion 8 mag., distance 3.5".
13 38	+ 28 53	3636 (5272), <b>Star Cluster in Canes Venatici</b> . Discovered by Messier and described as a brilliant nebula. Herschel first resolved it, in 1783, into a star cluster containing upwards of 1000 stars. A splendid object! From the photographic investigation of this cluster at Arequipa, it appears that out of the numerous stars it contains, not fewer than 132 are variable.
13 38	+ 36 9	3637 (5273), <b>Nebula in Canes Venatici</b> . Of moderate brilliancy, fairly large, circular, brighter in the centre.
13 43	+ 17 57	$\tau$ <b>Bootis</b> . A star of 5 mag., with a very faint companion, d. = 8.5", p. = 352°.
13 44	+ 49 49	$\eta$ <b>Ursae Majoris</b> , 2.5 mag. This star gives a beautiful spectrum of Vogel's Class Ia., in which a broad somewhat washed-out line appears, similar to that visible in some of the stars of Orion.
13 57	+ 2 1	$\tau$ <b>Virginis</b> . A star of 4 mag., with a faint companion 8.5 mag., d. = 79", p. = 290°.
14 9	+ 19 32	$\zeta$ <b>Bootis</b> . A star of 9.5 mag., seen by Baxendell 9th April, 1860; on 11th of April it was 10 mag., and on 20th 13 mag.; on the 23rd it became invisible, and has not since been seen.
14 10	+ 52 16	$\kappa$ <b>Bootis</b> . A star of 4 mag., of a greenish-white colour, with a bluish companion at 12.7" distance.
14 11	+ 19 44	$\alpha$ <b>Bootis (Arcturus)</b> . A brilliant star 1 mag., with a beautiful spectrum (Vogel, Class IIa.). Its colour is a bright reddish-yellow. At distance 43" is a star of 9 mag.
14 13	+ 51 59	$\iota$ <b>Bootis</b> . This star, 4.5 mag., has a companion 7.5 mag., at distance 38". Struve (1836) saw the primary as double; Mädler, too, in 1842, believed he could do so, since then no similar observation has been made, and its duplex nature is therefore doubtful.
14 20	+ 51 16	$\delta$ <b>Bootis</b> . A variable star of a reddish colour, discovered at Bonn in 1860. At maximum it is 8 mag., at minimum 12.5 to 13 mag. Period 29.8 days.
14 23	- 1 48	$\phi$ <b>Virginis</b> , 5 mag., with a companion 10 mag., d. = 3.7", p. = 109°.
14 24	- 5 32	3900 (5634), <b>Nebula in Virgo</b> . Of moderate brilliancy, small, condensed at the centre; thought by J. Herschel capable of being resolved.
14 24	+ 28 44	$\Sigma$ 1850, <b>Bootis</b> , 6 mag., with a companion 7 mag., d. = 26", p. = 262°.

Right  
Ascension  
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h m ° '

14 33 + 27 10

**R Bootis.** A variable star, at maximum it is 6 mag., and reddish in colour, at minimum it sinks to 12 mag. Period 223 days. Recognised as variable at Bonn in 1858.

14 35 + 0 8

3964 (5713), **Nebula in Virgo.** Discovered by W. Herschel 11 April, 1787, and classed by him among the brilliant nebulae. J. Herschel considered it capable of being resolved into stars.

14 36 + 16 51

**$\pi$  Bootis.** A star 5 mag., with an easily distinguished companion 6 mag., distance 6".

14 36 + 14 9

**$\zeta$  Bootis.** The primary, 3.5 mag., has two companions; the nearer, 4 mag., is at present so close to the primary that only instruments of the first class can distinguish it. According to Perrotin, the distance in 1883 was 0.6", the position angle 297°. The farther companion is at distance 90", position angle 27°.

14 41 + 27 30

**$\epsilon$  Bootis.** One of the most beautiful of the double stars. The primary is 3 mag., and yellow, the companion 6 mag., and blue; distance 2.6". The colours are very decided, and their contrast has a pretty effect.

14 44 - 13 44

**$\mu$  Librae.** A star of 5 mag., with a companion of 6 mag. at  $d. = 1.6''$ ,  $p. = 340^\circ$ . Burnham, in addition to this, discovered three other feeble companions.

14 45 - 15 35

**$\alpha$  Librae,** 3 mag., with a companion 4 mag., distance 230".

14 47 + 19 31

**$\xi$  Bootis,** 4.7 mag., and yellowish, with a red companion 6.5 mag. The distance of this latter is rapidly decreasing. In 1882 it was 3.9", while in 1829 it was, according to Struve, 7.2". The position angle is also rapidly changing. The period of revolution seems to be 127 years.

14 46 + 49 7

**39, Bootis.** A double star 6 and 6.5 mags., distance 3.7". The primary is white, the companion reddish.

14 52 - 20 56

**Anonyma in Libra.** A remarkable multiple star. The primary is 6 mag., one companion (*B*), 7.5 mag. The rest are all very faint. Burnham (1878) gives the following measurements:—

A B,  $d. = 15.1''$ ,  $p. = 290^\circ$

A E,  $d. = 69.4''$ ,  $p. = 52.5^\circ$

A C,  $d. = 120.6''$ ,  $p. = 322^\circ$

A F,  $d. = 105.5''$ ,  $p. = 166.5^\circ$

A D,  $d. = 52.5''$ ,  $p. = 171.0^\circ$

The primary and the more brilliant companion compose a system with very decided proper motion. The other stars do not really, but only appear to, belong to it.

14 56 - 8 7

**$\delta$  Librae.** Variable, and belongs to the Algol type. Schmidt recognised its variability in 1859. Period 2 days 7<sup>h</sup> 21.3<sup>m</sup>. The changes of brilliancy only occupy 12 hours. At maximum the star is 5, at minimum 6 mag.

14 56 + 54 20

4029 (5821), **Nebula in Draco.** Irregular, faint but large. Discovered by W. Herschel, 5 May, 1788.

15 1 + 48 2

**44, Bootis.** A yellowish star 5 mag., with a blueish companion 6 mag., distance 5". Both primary and companion seem to be variable to a slight degree.

15 7 - 19 25

**$\iota$  Librae.** A star 5 mag., with a companion 9 mag.,  $d. = 57''$ ,  $p. = 110^\circ$ . Burnham found the companion itself to be double, consisting of two stars of 10 mag.,  $d. = 1.7''$ ,  $p. = 17^\circ$ .

Right Ascension 1900		Declination 1900		
<i>h</i>	<i>m</i>	<i>h</i>	<i>m</i>	
15	8	+ 19	39	Σ 1919, <b>Bootis</b> , 6 mag., and somewhat yellowish, with a white companion 7 mag., distance 25", position angle 10°.
15	11	+ 38	40	Σ 1926, <b>Bootis</b> , 6 mag., with a companion 8 mag., d. = 1.6", p. = 261. A difficult double star.
15	12	+ 33	42	δ <b>Bootis</b> , 3 mag., and white. At distance 105", is a companion 7.5 mag., position angle 79°, whose position has not changed for 50 years.
15	14	+ 2	27	4083 (5904), <b>Star Cluster in Serpens</b> . Observed by Messier in 1764 and described as a beautiful, circular nebula 3' in diameter. Messier says: "In clear weather it can be seen very well with an ordinary telescope of 1' focus." Kirch, in 1702, was the first to discover this nebula. Messier could find in it no trace of stars. Nevertheless, an average telescope shows that it is a cluster of stars and no nebula. Herschel, with his 40-foot reflector, could distinguish over 200 stars, though towards the centre they were so densely placed that it was impossible to resolve them. Rosse says the cluster is 7' to 8' in diameter, the stars ranging from 12 to 15 mag. From photographic investigations of this cluster at Arequipa, it appears that 85 of the 900 stars into which it is resolvable, are variables. The periods of variability lie usually between 11 and 17 hours, and the range of light changes between 13.7 and 14.7 mag. The period of light variability is for all of them fairly alike. It is probable that they are all affected by a common cause of which we are at present ignorant.
15	14	+ 2	9	5, <b>Serpentis</b> , 5 mag., with a faint companion 10 mag., d. = 10.6", p. = 41, the position of which does not seem to alter. Struve, in 1836, believed the primary to be itself double, but this view has not been since corroborated.
15	14	+ 10	47	Σ 1931, <b>Serpentis</b> , 6 mag., with a companion 7.5 mag., d. = 13", p. = 173°. No change of position has been noticed in last 50 years.
15	14	+ 27	12	Σ 1932, <b>Coronae</b> . The primary is 5.5 mag., and has a companion 6 mag.; both white. Distance, according to Hall, 1886, 0.9", position angle 130°.
15	14	+ 32	1	γ <b>Coronae</b> . A variable star of the Algol type, recognised by Winnecke in 1863. At maximum 7.5 mag., at minimum 8.9 mag. Period 3 days 10 <sup>h</sup> 51 <sup>m</sup> 2 <sup>s</sup> . The decrease in brilliancy occupies 4.5 <sup>h</sup> , the increase 5.2 <sup>h</sup> . The brilliancy at maximum varies somewhat.
15	14	- 19	57	S <b>Librae</b> . Variable, slightly reddish in colour; at maximum only 8 mag., at minimum under 12 mag. The changes of brilliancy are very irregular. Discovered by Borrelly in 1872.
15	17	+ 14	40	S <b>Serpentis</b> . A reddish star, noted by Lalande in 1794 as of 8 mag., but which could no longer be found by Harding in 1807. Its variability was not recognised till 1828. At maximum it is 7 to 8 mag., at minimum under 12 mag. Period 365 days.
15	17	+ 31	44	S <b>Coronae</b> . Of a reddish-yellow, recognised as variable by Hencke in 1860. Maximum 6 to 8, minimum 12 mag. Period 364 days.
15	19	+ 39	39	η <b>Coronae</b> . A yellow star of 5.2 mag., with a golden-coloured companion 5.7 mag.; it is extremely close to the primary, the distance (Engelmann, 1884) being only 0.6". Period 11.3 years. There is another companion 11 mag., d. = 30", p. = 38°.

Right Ascension, 1900.	Declination, 1900.	
15 21	+ 37 42	$\mu$ <b>Bootis</b> . A yellow-greenish star, 4 mag., with a companion ( $\mu^2$ ) 6.5 mag., distance 108", position angle 172°. This latter is itself double, but, at present, can be divided only with a powerful telescope.
15 23	+ 39 49	$\epsilon$ <b>Draconis</b> , 3 mag., yellowish, with a companion of 9 mag., d. = 255", p. = 50°.
15 30	+ 10 53	$\delta$ <b>Serpentis</b> . Yellowish, 3.5 mag., with a companion 4 mag., d. = 3", p. = 197°.
15 33	- 8 28	$\Sigma$ 1962, <b>Librae</b> . Two stars 6.8 mag., distance 12", position angle 189°.
15 34	+ 36 34	$\Sigma$ 1964, <b>Coronae</b> . A star of 7 mag., with a companion 7.5 mag., distance 15.5". Burnham found that this companion was itself double, d. = 1.3", p. = 10°.
15 36	+ 36 58	$\zeta$ <b>Coronae</b> , 4 mag., with a companion 5 mag., d. = 7", p. = 303°.
15 36	+ 80 47	$\pi^1$ <b>Ursae Minoris</b> , 6 mag., yellowish, with a yellowish companion 7 mag., d. = 30", p. = 83°.
15 39	+ 20 36	$\gamma$ <b>Coronae</b> . A greenish-white star, 4 mag., with a reddish companion 7 mag., distance (when discovered by Struve in 1826) 0.7". In the following year it could no longer be divided, and it was not seen again until the end of the fiftieth year, and then only with great difficulty. Even Burnham, in 1880, found the primary star only, and apparently quite round. Engelmann, however, in 1883-84, occasionally saw it as clearly elongated. The period of revolution of the companion amounts to 85 years.
15 39	+ 6 44	$\alpha$ <b>Serpentis</b> . A star of 2.5 mag., with a beautiful spectrum (Vogel, Class IIa.). There is a star of 12 mag., at distance 59", position angle 353°.
15 42	+ 15 44	$\beta$ <b>Serpentis</b> , 3.5 mag., and somewhat blueish. There is a companion of 9 mag., d. = 30.6", p. = 265°.
15 44	+ 28 28	$R$ <b>Coronae</b> . A red star, recognised as variable by Pigott in 1785. The changes of brilliancy are very irregular, and often imperceptible for years together. At maximum it is 5.8 mag., at minimum it is invisible even in a most powerful telescope.
15 46	+ 15 26	$R$ <b>Serpentis</b> . Yellowish-red, recognised as variable by Harding in 1826. At maximum it is 5.6, at minimum less than 12 mag. The changes of brilliancy are irregular. Period nearly 357 days.
15 48	+ 33 16	$\Sigma$ 1984, <b>Draconis</b> . A star of 6.5 mag., with a companion 8.5 mag., d. = 6.4", p. = 276°.
15 52	+ 38 14	$\lambda$ <b>Coronae</b> . A star of 6 mag., with a feebler companion at d. = 95", p. = 57°.
15 57	+ 33 37	$S$ <b>Coronae</b> . A star of 5.5 mag., with a companion of 11 mag. South found for the latter in 1825 d. = 79", p. = 125°.
15 55	+ 26 12	$T$ <b>Coronae</b> [Nova]. A so-called new star, but which was catalogued at Bonn as a star of 9.5 mag. as far back as 1855. On 12 May, 1866, it was visible to the naked eye, and soon reached the magnitude of $\alpha$ Coronae. On 13 May, its brilliancy already began again to decrease; on 20 May, it could only be seen with a telescope; by the middle of June it was of 9 mag., and had so remained with but slight variations. At the time of its greatest brilliancy, it was rather yellowish, and was described by Baxendell as a yellowish star seen through a blue veil. From Mr. Roberts' photograph of the region about Nova, taken in 1890, it would seem that six of the stars in D'Arrest's chart of 1864 had disappeared.



Right Ascension, 1800.	Declination, 1800.
15 59	- 11 6
16 0	- 19 32
16 0	+ 58 49
16 2	+ 13 35
16 4	+ 17 19
16 6	- 19 12
16 9	+ 13 48
16 11	+ 34 7
16 11	- 22 44
16 13	+ 29 24
16 15	- 25 24

ξ **Scorpius**. Triple. A star of 5 mag. with two companions 5.5 and 7 mag. The nearer companion was in 1888  $d. = 1''$ ,  $p. = 29'$ , and the distance seems to be increasing. The farther in 1883 was  $d. = 7.2''$ ,  $p. = 65'$ .

β **Scorpius**, 2 mag., with a companion 5 mag., at distance 13". Burnham, in 1879, divided the primary into two stars of 2 and 10 mags., distance 0.9". A 12-inch refractor is necessary to distinguish this double star.

ζ **Draconis**. A star of 3.5 mag., which, from investigations made at the Lick Observatory, is a spectroscopic double star, with a period of revolution of only 9 days.

Σ 2007, **Herculis**. A double star, 6.5 mag. and 8 mag.; distance 32", position angle 328°.

κ **Herculis**. A yellowish star, 5 mag., with a somewhat reddish companion, 6 mag., distance 31".

ν **Scorpius**. An easily observed double star, 4 and 7 mags., distance 40.5"; thus observed by both Herschel and South. Mitchell, however, at Cincinnati in 1846, found that the companion is itself double, and consists of two stars of 6.5 mag. at distance 1.8". Lastly, Burnham in 1874 divided the primary also into two stars, but the distance is only 0.8".

49 **Serpentis**. Primary 6.5 mag., companion 6.7 mag., distance 3".

σ **Coronae**, 5.5 mag., yellowish, with a blueish companion, 6 mag., distance 3.8". There is also a star 10 mag.,  $d. = 51''$ ,  $p. = 88'$ , besides a faint star,  $d. = 4.9''$ ,  $p. = 49'$ .

4173 (6093), **Star Cluster in Scorpio**. Discovered by Messier in 1781, and described as a circular nebula, 2' in diameter, with brilliant centre, like the nucleus of a comet. Later on Herschel, with the aid of his great telescope, found that the object was in reality a star cluster, the stars in which are exceedingly dense. On 21 May, 1860, Auwers saw a star of 6.5 mag. in the cluster which had not been visible there before, and this observation was confirmed a few days later by Pogson. The star was already decreasing, and by the middle of June, 1860, was no longer visible. Near it are two variable stars *R* and *S*. The former, discovered by Chacornac in 1853, is faint at maximum, being only 9 mag., and at minimum is almost under 13 mag. The change of brilliancy occupies 223 days. The latter (*S*) varies between 9 and 13 mag. Period only 177 days. Neither star is of any particular colour.

ν **Coronae**. A star of 6 mag., with a companion of 9 mag., and three other very faint companions.

Burnham gives (1879) the following measurements:

	d.	p.		
A B	86.3"	22.4	A	6 mag.
A C	123.6"	52.3	C	9 "
B D	13.2"	222.7	D	13 "
A a	56.1"	29.5	a	12 "

σ **Scorpius**, 3.5 mag., with a companion 8 mag.,  $d. = 20.4''$ ,  $p. = 271'$

Right Ascension 1900.		Declination. 1910.		
n	m.	°	'	
16	18	- 26	17	4183 (6121), <b>Nebula in Scorpio</b> . A dense cluster of very small stars, almost on the parallel of Antares, and $1\frac{1}{2}$ degree to the west of it. Observed by Lacaille, and included in his list; Messier saw the cluster in 1764, and remarks that it is $2\frac{1}{2}$ minutes in diameter, and looks like a patch of nebula in a telescope of low power. W. Herschel (in 1783) resolved, with a 10-foot reflector, the whole into stars.
16	18	+ 19	23	$\gamma$ <b>Herculis</b> , 4 mag., with a companion 8 mag., distance $40''$ , position angle $239^\circ$ .
16	20	- 23	13	$\rho$ <b>Ophiuchi</b> . A star of 5.5 mag., which is apparently to a slight degree variable, with a companion 7.5 mag., d. = $4''$ , p. = $2^\circ$ .
16	21	+ 19	7	$U$ <b>Herculis</b> . Recognised as variable by Hencke in 1860. At maximum it sometimes reaches 6.5 mag., at minimum it is under 11 mag. Period nearly 409 days.
16	23	- 26	13	$\alpha$ <b>Scorpionis (Antares)</b> . A brilliant star, 1 mag., with a companion 7.5 mag., d. = $4''$ , p. = $276^\circ$ . The companion was discovered simultaneously at Rome and Cincinnati in 1849. Bürg at Vienna, 13 April, 1819, when Antares was eclipsed by the moon, and when Antares should have come from behind the moon's disc, saw a star of 6.5 mag., which, 5 seconds later, seemed suddenly to attain the same brilliancy as Antares. He at once came to the conclusion that Antares was a double star. Its spectrum belongs to Group II.
16	23	+ 61	55	99, <b>Draconis</b> , 5.5 mag., with a companion 7 mag., distance (1889) only $1''$ .
16	23	+ 61	44	$\eta$ <b>Draconis</b> . A star of 2.5 mag., yellow, with a companion 9.5 mag., d. = $4.8''$ , p. = $143^\circ$ . Burnham has seen several other very minute stars in the vicinity.
16	25	+ 42	6	30, $g$ <b>Herculis</b> . Recognised as variable by Baxendell in 1857. The changes of brilliancy are very irregular. At maximum the star is 5, and at minimum 6 mag.
16	26	+ 2	13	$\lambda$ <b>Ophiuchi</b> . A yellowish star of 4 mag., with a blueish companion 5.5 mag. The distance, which is increasing, was in 1891 $1.6''$ , position angle $48^\circ$ .
16	27	- 12	50	4211 (6171), <b>Star Cluster in Ophiuchus</b> . An extensive cluster of small stars. Discovered by W. Herschel on 12 May, 1793, and described as a very beautiful, rich, and dense cluster, 5' to 6' in diameter, in which the stars are collected with gradually increasing density towards the centre. Five brilliant stars are to be seen round the cluster.
16	34	+ 53	8	16, 17, <b>Draconis</b> appears, to the naked eye, like a star of 4.5 mag.; in reality it consists of two brilliant stars of 5 mag., at d. = $90''$ . The one which follows is double, having a companion 6 mag., at d. = $3.7''$ , p. = $113^\circ$ .
16	36	+ 4	24	$m$ <b>Herculis</b> appears, to the naked eye, like a star of 6 mag. In reality it is two stars of 6 mag., at distance $69''$ .
16	36	+ 49	7	42, <b>Herculis</b> . A star of 4.5 mag., with a faint companion 11 mag., d. = $22''$ , p. = $92^\circ$ .
16	38	+ 31	47	$\zeta$ <b>Herculis</b> . A brilliant white star of 3 mag., with a companion 6.5 mag.; d. = $1.4''$ , p. = $64^\circ$ (1891). W. Herschel discovered the companion in July, 1782, but, later on, could no longer see it. It was next observed in 1826

Right Ascension 1900.	Declination 1900.
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h.	m.
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16 38	+ 36	39
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with the Dopat refractor. Bunnham in 1880 gave:  $d = 1.4''$ ,  $p = 114^\circ$ . The companion's period of revolution seems to be only 35 years. According to photo-spectroscopic measurements of Belopolsky, the motion of  $\zeta$  in the direction towards our sun is at the rate of 14 miles per second.

4230 (6205), **Star Cluster in Hercules**. A magnificent cluster visible on a clear night to the naked eye, as a light cloud, as remarked by Halley who discovered it in 1714. Messier observed this object in 1764, and says that it can be seen with a 1-foot telescope as a starless nebula, brilliant, circular, brighter at the centre. Its diameter is estimated by Messier to be 6', and the same astronomer remarks that the nebula is situated near two stars of 8 mag., of which one is above, the other beneath it. A 4-inch refractor will resolve the nebula into stars, and Secchi, with his 9-inch refractor, found the stars to be distributed over a space 8' in diameter. Their number is probably 5000 to 6000, and Rosse has noticed a remarkable spiral grouping among them. The great 36-inch refractor of the Lick Observatory has thoroughly resolved the central glow of nebulosity into separate points. The brothers Henri and Professor Scheiner furnished photographs of this cluster in 1896.

16 40	+ 23	59
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4234 (6210), **Nebula in Hercules**. A blueish, planetary nebula, circular, 8' in diameter, and ill-defined at the edges. Its spectrum shows the nebula to be composed of incandescent gas, being characterised by the three bright lines, of which the first is the most brilliant. Elsewhere the spectrum is dull and continuous. Webb describes the appearance of this nebula by saying that it looks like a star which has not been properly focussed in the telescope. From photo-spectroscopic measurements made by Kesler, this nebula is approaching the sun at a rate of 11.2 miles per second.

16 42	- 1	46
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4238 (6218), **Star Cluster in Ophiuchus**. Discovered by Messier in 1769, and described as a faint, circular, starless nebula, 3' in diameter, near which there is a star of 9 mag. In 1783 Herschel's reflector resolved the nebula into stars showing a cluster of 7' to 8' in diameter, at the centre of which the stars are very densely collected. Rosse makes it a spiral nebula.

16 42	+ 2	14
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19, **Ophiuchi**, 6 mag., with a companion 9 mag.,  $d = 22''$ ,  $p = 93^\circ$ .

16 42	+ 35	49
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$\Sigma$  2101, **Herculis**. A star of 6 mag., with a companion 9 mag.,  $d = 4''$ ,  $p = 60^\circ$ .

16 44	+ 47	42
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4244 (6229), **Nebula in Hercules**. A large, round but faint, planetary nebula, discovered by W. Herschel 12 May, 1787. It forms a triangle with two stars of 6 mag.

16 45	+ 36	5
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$\Sigma$  2104, **Herculis**. A pretty double star, 6.5 and 8.5 mags., distance 6''

16 47	+ 15	6
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**S Herculis**. Of a clear red colour and variable, discovered at Bonn in 1856. At maximum it is 6 mag., sometimes only 7 mag.; at minimum it decreases to 11.5 or 12 mag. Period 308 days.

16 52	- 3	57
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4256 (6254), **Star Cluster in Ophiuchus**. Discovered by Messier, 29 May, 1763, and described as a faint, circular, starless nebula, which cannot be discerned without difficulty with a 3-foot telescope. W. Herschel was the first to resolve this nebula into a densely crowded star cluster. These stars are partially visible in a 4-inch refractor.

Right Ascension, 1900.		Declination, 1900.		
h.	m.	°	'	
16	54	- 12	44	<b>Nova Ophiuchi, 1848.</b> On 28 April of this year, Hind saw a star 4.5 mag., of a yellowish-red colour in this place, where it had never before been visible. The star maintained this brilliancy till 10 May; it then began to decrease, and is now under 12 mag.
16	55	- 29	56	4261 (6266), <b>Star Cluster in Scorpio.</b> A beautiful nebula, discovered by Messier, 7 June, 1771, and described by him as like a comet. The nebula was resolved into stars by W. Herschel, with his 20-foot telescope. It is beyond the reach of ordinary refractors.
16	56	- 26	7	4264 (6273), <b>Star Cluster in Ophiuchus.</b> Discovered by Messier, 5 June, 1764, catalogued by him as a starless nebula, situated on the parallel of Antares, 3' in diameter, and of which a good view can be obtained with 3½-foot telescope. W. Herschel, in 1784, proved it to be a globular star cluster.
16	58	+ 82	14	ε <b>Ursae Minoris.</b> A star of 4 mag., with a companion of 12 mag., at d. = 78", p. = 6°. From investigations made at the Lick Observatory, ε is itself a spectroscopic double, with a period of revolution of only a few weeks.
16	58	- 24	37	4268 (6286), <b>Star Cluster in Ophiuchus.</b> Discovered by W. Herschel, 2' to 2½' in diameter, brilliant, and more condensed towards the centre; easily resolved. According to W. Herschel, the stars are of a faint red colour.
16	59	- 22	34	4269 (6287), <b>Star Cluster in Ophiuchus.</b> Discovered by W. Herschel, 21 May, 1784. It is globular, fairly brilliant, round, somewhat condensed towards the centre, and easily resolved.
17	2	- 15	58	<b>R Ophiuchi.</b> Reddish, and recognised as variable by Pogson in 1853. At maximum it is not more than 7 mag., at minimum it is under 12. Period 303 days.
17	3	+ 54	36	μ <b>Draconis,</b> 4.5 mag., with a companion 5 mag., d. = 2.4", p. = 159°.
17	4	- 26	26	4270 (6293), <b>Star Cluster in Ophiuchus.</b> A globular cluster, fairly brilliant, large and round, with a sudden increase in brightness towards the centre; can be resolved into stars. It is followed by a faint nebula.
17	9	- 26	27	36, <b>Ophiuchi,</b> 5.5 mag., and of a golden yellow, with a companion 6 mag., distance 4", position angle 197° (1888).
17	10	+ 14	30	α <b>Herculis.</b> A variable star of a yellowish-red colour, 3 mag., recognised as such by Herschel in 1795. The changes in brilliancy are not very great, but very irregular. At minimum it is over 4 mag. It has a companion of 6 mag., distance 4.7". It has a beautiful spectrum of type III.
17	11	+ 24	57	δ <b>Herculis,</b> 3 mag., of a greenish-white, with a blueish companion 8 mag., d. = 18", p. = 183°. A beautiful object.
17	12	+ 1	19	<b>U Ophiuchi.</b> A remarkable variable star, discovered by Sawyer in 1881. It is generally of 6 mag., and at minimum decreases to 6.7 mag. The period is only 20 <sup>h</sup> 8 <sup>m</sup> , and the change of brilliancy occupies the short space of 5 hours. The star belongs to the Algol type.
17	12	- 24	11	39, <b>Ophiuchi,</b> 6 mag., with a companion 7.5 mag., distance 15".
17	13	- 18	25	4287 (6333), <b>Star Cluster in Ophiuchus.</b> Discerned by Messier, and described as a faint, circular nebula 3' in diameter. In 1784, Herschel resolved it into stars, with a 20-foot reflector.

Right Ascension 1900.		Declination 1900.			
$h^{\circ}$	$m'$	$+$	$^{\circ}$		
17	14	+	43	15	4294 (6341), <b>Star Cluster in Hercules</b> . Described by Messier as a starless nebula, with a brilliant centre, easily discerned with a small telescope. A refractor of moderate power will resolve the nebula into stars, which are distributed over an area 8' in diameter. The centre could not be resolved even in Rosse's telescope. The whole shows a spiral arrangement.
17	14	+	33	12	68 <i>u</i> <b>Herculis</b> . A variable star, varying from 4.5 to 5.5 mag., and red in colour. The period, according to Schmidt, who discovered it, is very irregular.
17	15	-	12	45	$\nu$ , <b>Serpentis</b> , 4.5 mag. There is a star of 9 mag. at $d. = 51''$ , $p. = 31^{\circ}$ .
17	18	-	17	43	4296 (6356), <b>Nebula in Ophiuchus</b> . A brilliant nebula, discovered by W. Herschel, 17 June, 1784. It is of considerable size, brighter towards the centre, and can be resolved into numerous very small stars with a powerful telescope.
17	20	+	37	14	$\rho$ <b>Herculis</b> . A greenish-white star, 4 mag., with a companion (also somewhat green), 5 mag., distance 3.6".
17	23	+	11	28	$\Sigma$ 2166, <b>Ophiuchi</b> , 5.5 mag., with a companion 7.5 mag., distance 28", position angle 283°.
17	23	-	23	40	4302 (6369), <b>Nebula in Ophiuchus</b> . Annular, faint, and small.
17	25	-	21	24	<b>Nova in Ophiuchus, 1604</b> . At this point there appeared, in October, 1604, a star of 1 mag., with a sparkling light, second to Venus only in brilliancy. It remained till the spring of 1605, continually decreasing, and then vanished entirely.
17	25	-	0	59	$\Sigma$ 2173, <b>Ophiuchi</b> . A star of 6 mag., golden-yellow in colour, with a companion 6.5 mag., which is very close to its primary. Hall gave in 1891: $d. = 1''$ , $p. = 160^{\circ}$ .
17	30	+	9	39	53 <i>f</i> , <b>Ophiuchi</b> . A star of 5.5 mag., recognised as double by Herschel in 1781. The companion is 7.5 mag., and apparently does not change its position. Distance 41", position angle 191°.
17	30	+	13	43	54, <b>Ophiuchi</b> , 6 mag., with a very faint companion 11.5 mag., $d. = 21.4''$ , $p. = 77^{\circ}$ .
17	30	+	55	15	$\nu$ <b>Draconis</b> . Two stars of 4.5 mag., visible to the naked eye as a star of 4 mag. Distance 62".
17	32	-	3	11	4315 (6402), <b>Star Cluster in Ophiuchus</b> . A globular cluster, 7' in diameter, easily seen as a circular nebula. Messier discovered it in 1764, and described it as a starless nebula, not large, faint, standing near a small star of 9 mag., easily seen with an ordinary 3½-foot telescope. W. Herschel resolved the nebula into stars with his 20-foot reflector. With a 4-inch refractor, evidence of its resolvability is apparent. It is surrounded on three sides by several brilliant stars.
17	32	+	21	4	$\Sigma$ 2190, <b>Herculis</b> , 6 mag., with a companion 8.5 mag., $d. = 10''$ , $p. = 23^{\circ}$ .
17	33	+	75	47	4321 (6412), <b>Nebula in Ursa Minor</b> , 3' in extent, brighter towards the centre. W. Herschel, who discovered it, took it to be a star cluster at an immeasurable distance.
17	37	+	24	33	83, <b>Herculis</b> , 6 mag., with a companion 8.5 mag., at distance 16". The distance seems to be slowly increasing.

Right Ascension, 1900.		Declination, 1900.		
h.	m.	°	'	
17	40	+	2 37	61, <b>Ophiuchi</b> . A double star, 5.5 and 6 mag., d. = 21", p. = 94°. No change of position has been observed since Herschel's time.
17	41	-	27 48	X <b>Sagittarii</b> . Recognised as variable by J. Schmidt, in 1866. The star varies between 4 and 6 mags., within a period of 7 days.
17	42	+	17 45	Σ 2215, <b>Herculis</b> , 6 mag., with a companion 8 mag., distance only 0.8", angle 296° (1886).
17	43	+	27 48	μ <b>Herculis</b> , 4 mag., and yellowish, with a companion 9.5 mag., d. = 30", p. = 241°. In 1856 Clark discovered that the companion itself is double, consisting of two stars of 11 mag., which were then at distance 1.8". This distance has since steadily decreased, and is, 1891, only about 0.5". A very difficult object. Period 45.4 years.
17	44	+	72 12	ψ <b>Draconis</b> . A star of 4 mag., with a companion 5 mag., distance 31". Recognised as double by Flamsteed.
17	48	+	23 6	4343 (6482), <b>Nebula in Hercules</b> . Small, round, rather brighter towards the centre, with a small nucleus.
17	51	-	19 0	4346 (6494), <b>Star Cluster in Ophiuchus</b> . A beautiful cluster, discovered by Messier, 20 June, 1764. Its diameter is 15', and in this space there are nearly 80 stars of 9 to 12 mag. The stars seem to be scattered over the whole field of vision, the lowest magnifying power must therefore be used.
17	54	+	51 31	γ <b>Draconis</b> , 2.5 mag., with a faint companion 11 mag., d. = 125", p. = 116°. Burnham saw, besides, an exceedingly faint star, 13 mag., d. = 21", p. = 152°; also a star 13.5 mag., d. = 45.7", p. = 230°; a star 13 mag., d. = 57", p. = 16°; a star 11.5 mag., d. = 97", p. = 235°, and a star 11 mag., d. = 139", p. = 28°.
17	56	+	2 56	67, <b>Ophiuchi</b> . This star, 5 mag., has, at distance 55", a red companion 8 mag. The contrast of colour in these stars is pretty. Burnham discovered also three extremely feeble companions.
17	56	-	23 2	4355 (6514), <b>Nebula in Sagittarius</b> . A group containing several nebulae. Erroneously described by Messier as a star cluster. In 1874, Herschel saw three nebulae, with a double star in their midst. J. Herschel found this star to be triple. The star (or the nebulae) seems to rapidly change its position.
17	57	-	30 2	4359 (6520), <b>Star Cluster in Sagittarius</b> . Globular, fairly brilliant, condensed towards the centre. The stars are exceedingly small.
17	57	+	21 36	95, <b>Herculis</b> , 5 mag., somewhat greenish, with a companion 5.5 mag., distance 6".
17	58	-	24 23	4361 (6523), <b>Star Cluster in Sagittarius</b> . A very beautiful object, discovered by Messier in 1764, and described by him as a star cluster. It really consists of several nebulae, with a triple star and numerous others near to it.
17	58	-	8 11	τ <b>Ophiuchi</b> , 5 mag., with a blueish companion 9 mag., d. = 100", p. = 127°. The primary, as discovered by W. Herschel, is itself a double star. Schiaparelli in 1882 found d. = 1.9", p. = 252°.
17	59	-	22 30	4367 (6531), <b>Star Cluster in Sagittarius</b> . Discovered by Messier in 1764, and a beautiful object. The stars are of 8 mag. and under. Messier says they are mingled with nebulae.

Right Ascension 1900.		Declination 1900.		
h.	m.	°	'	
17	59	- 29	35	<b>W Sagittarii.</b> Recognised as variable by J. Schmidt in 1865. At maximum it is 5, at minimum 6 mag. The period seems to be 7.29 days.
17	59	+ 66	38	4373 (6543), <b>Nebula in Draco.</b> Discovered by Herschel, 15 February, 1786. He describes it as a planetary nebula of great brilliancy, $3\frac{1}{2}''$ in diameter, one edge very ill-defined. A long and careful examination reveals a brilliant, well-defined centre, round in shape. The nebula can be seen very well with a $3\frac{1}{2}$ -inch refractor. It gives a beautiful spectrum of three bright lines. Huggins found the third line the faintest. Vogel on the other hand, declares it to be quite as brilliant as the second. The Lick refractor has shown that this nebula has a helical form. From Keeler's photo-spectroscopic measurements, this nebula is approaching the sun at the rate of 31 miles per second.
18	0	+ 2	33	70, <b>Ophiuchi</b> , 4 mag., and yellow, with a red companion, 6 mag., distance (Schiaparelli, 1882) $2.3''$ . Since Herschel's time, this companion has completed more than a full revolution round the primary. Period of revolution 88 years. The parallax is $0.16''$ , the distance from the earth = 1,300,000 radii of the earth's orbit. The mean distance of the companion from its primary is 4300 million kilometers, or nearly 30 radii of the earth's orbit, and the whole mass of the system is equal to about three times that of our sun.
18	0	+ 48	28	$\Sigma$ 2277, <b>Herculis</b> , 6 mag., with a companion 8 mag., at distance $28''$ .
18	1	- 23	14	4376 (6546), <b>Star Cluster in Sagittarius.</b> Large and fairly rich.
18	3	+ 30	33	99, <b>Herculis.</b> A star of 6 mag., with a very feebly shining companion of 11 mag., which was discovered by Burnham. The distance of the latter is only $0.7''$ , and the period of revolution 53.3 years.
18	4	+ 26	5	100, <b>Herculis.</b> Two stars 6 mag., distance $14''$ .
18	5	+ 3	58	73, <b>Ophiuchi.</b> A difficult double star 6 and 7 mags. The distance seems to have decreased since Struve observed it. In 1836 it was only $0.7''$ .
18	5	+ 31	0	<b>T Herculis.</b> A variable star, discovered at Bonn in 1857. Its brilliancy ranges from 7 to 12 mag. It is of a deep red colour. Period 165 days.
18	6	+ 16	27	$\Sigma$ 2289, <b>Herculis.</b> A star of 6 mag., with a companion 7 mag., distance only $1.2''$ .
18	6	- 21	37	4388 (6568), <b>Star Cluster in Sagittarius.</b> A fairly large and scattered cluster of stars, ranging from $9.5$ to 11 mag.
18	7	+ 6	50	4390 (6572), <b>Nebula in Ophiuchus.</b> Fairly brilliant, planetary. Its spectrum contains the three early recognised bright lines, of which the first is the most brilliant, the last (falling on <i>F</i> ), the faintest. According to Huggins, it has a faint continuous spectrum with the three chief nebula lines.
18	8	- 21	5	$\mu$ <b>Sagittarii.</b> A quintuple star; primary 3.5 mag., and yellowish, has a companion 9 mag., $d. = 48''$ , $p. = 312^{\circ}$ ; another 10 mag., $d. = 50''$ , $p. = 115^{\circ}$ . The other two companions, seen by Burnham, are merely faint points of light.
18	9	+ 79	59	40, 41, <b>Draconis.</b> Seen with the naked eye, these look like a star of 5 mag. They are really two stars 5.2 and 6 mags., distance $20''$ .
18	13	- 18	28	4397 (6603), <b>Star Cluster in Sagittarius.</b> A rich star cluster, discovered by Messier, 20 June, 1764. Nearly $1\frac{1}{2}$ in diameter. Visible to the naked eye as an offshoot of the Milky Way.

Right Ascension. 1900.		Declination. 1900.		
h.	m.	s.	°	
18	13	- 13	49	4400 (6611), <b>Star Cluster in Scutum Sobieski</b> . A cluster of small stars discovered by Messier on 3 June, 1764. It is 8' in diameter, and in the Finder looks like a faint nebula.
18	14	- 17	10	4401 (6612), <b>Star Cluster in Sagittarius</b> . Discovered by Messier at the same time as the cluster just mentioned, and described as less brilliant than it. Messier says that it looks like a nebula when seen with an ordinary 3½-foot telescope, while with a powerful instrument stars only are visible. Diameter 5'. Contains a double star 8.5 and 10.5 mags, distance 25".
18	15	- 16	13	4403 (6618), <b>Nebula in Sagittarius</b> . Something like a horseshoe in shape. Discovered by Messier, 3 June, 1764. He describes it as a luminous, starless streak, 5' to 6' in length, spindle-shaped, not unlike the nebula in Andromeda, but very faint. There are two stars near it, parallel with the equator, but visible only in a telescope. In clear weather a very good view of this nebula may be obtained with an ordinary 3½-foot telescope. W. Herschel was the first to get a perfect view of it. According to Holden, one arm of this nebula has changed its position. The spectroscope shows the nebula to be a mass of incandescent gas.
18	18	- 24	55	4406 (6626), <b>Star Cluster in Sagittarius</b> . A densely crowded cluster of very minute stars. Seen by Messier, 27 July, 1764, and described as a starless, circular nebula, not easy to distinguish with a 3½-foot telescope. Diameter 2'. A powerful instrument is required to disintegrate it.
18	19	- 20	35	21, <b>Sagittarii</b> . A star of 5 mag., which has, at distance 2.5", a faint companion 8 mag., discovered by Alvan Clark.
18	22	+ 0	8	59 <i>d</i> , <b>Serpentis</b> , 6 mag., yellowish, with a companion 7.5 mag., <i>d</i> . = 3.9", <i>p</i> . = 314°.
18	22	+ 71	17	φ <b>Draconis</b> . A double star, very difficult to resolve, of 4.8 mag and 6.5 mags., discovered by O. Struve at Pulkowa in 1856. Burnham found in 1882 the distance 0.5".
18	23	+ 6	30	4410 (6633), <b>Star Cluster in Ophiuchus</b> . Large, coarsely scattered; discovered by Caroline Herschel in 1783. This cluster has been measured by A. Nyland.
18	22	+ 58	45	39 <i>b</i> , <b>Draconis</b> , 5 mag., with a companion 8 mag., <i>d</i> . = 3.6", <i>p</i> . = 358°. Also another 7 mag., <i>d</i> . = 90", <i>p</i> . = 22°.
18	23	+ 74	31	4415 (6643), <b>Nebula in Draco</b> . A remarkable nebula, fairly large and brilliant, preceded by two stars. According to Tuttle, it is variable in brilliancy. D'Arrest, in writing on this subject to J. Herschel, 8 May, 1863, says that Tuttle's nebula was so brilliant and remarkable in the Finder (2' long and 80" broad) that he was convinced it had increased in brilliance since J. Herschel and his father observed it.
18	23	+ 72	41	χ <b>Draconis</b> . A star of 4 mag., which, from photographs of its spectrum taken by Campbell at the Lick Observatory, turns out to be a spectroscopic double, with a period of 282 days.
18	26	- 19	12	U <b>Sagittarii</b> . A variable star, discovered by J. Schmidt in 1866. At maximum it is 7 mag., at minimum 8.5 mag. Period 6.7 days.



Bayer Assignment 1800	Designation 1900	
18 26	- 19 2	<i>M</i> 25, <b>Star Cluster in Sagittarius</b> . A cluster of small stars, discovered by Messier 20 June, 1764. Can be seen with quite a small telescope. Burnham has measured several double stars in it.
18 30	- 23 59	4424 (6656), <b>Star Cluster in Sagittarius</b> . Discovered by Abraham Ihle, 1665. Messier could not distinguish any star in it, catalogued it as circular and easily seen with a common telescope of $3\frac{1}{2}$ feet. It is surrounded by 5 irregularly placed stars. Herschel's 10-foot telescope resolved the nebula into a star cluster. Towards the middle the stars are denser; diameter 8'.
18 31	- 8 18	4426 (6664), <b>Star Cluster in Scutum Sobieski</b> . Large, fairly rich, and of moderate density. Discovered by W. Herschel, 16 June, 1784.
18 33	+ 38 49	$\alpha$ <b>Lyrae</b> (Vega). This splendid star, 1 mag., has near it several faint stars, but their connection with it is merely optical. One of them, which was used by Struve and Brünnow as a comparison star for calculating the parallax of Vega, is of 9.5 mag., $d. = 48''$ , $p. = 156^\circ$ ; another of 9 mag., $d. = 150''$ , $p. = 40^\circ$ . Winnecke and Burnham have also measured a very faint star (13 mag.), $d. = 52''$ , $p. = 292^\circ$ . The spectrum of Vega belongs to the most beautiful of Class I. It shows the dark hydrogen lines with much intensity, and, in addition, some feeble lines of the metals. Several different values have been given to the parallax of Vega, but none of them is trustworthy, and the distance of this star consequently remains unknown.
18 36	- 4 51	4429 (6682), <b>Star Cluster in Scutum Sobieski</b> . Large and rich, but the stars are little more than minute luminous points.
18 40	- 9 30	4432 (6694), <b>Star Cluster in Scutum Sobieski</b> . Discovered by Messier, 2' in diameter.
18 41	- 1 3	5, <b>Aquilae</b> , 6 mag., with a blueish companion 7.4 mag., distance 13.2". There is also a second companion 11 mag., $d. = 27''$ , $p. = 145^\circ$ .
18 41	+ 39 30	$\epsilon$ and $\delta$ <b>Lyrae</b> . A very interesting pair of double stars, first observed by Flamsteed; with keen sight and under specially favourable circumstances $\epsilon$ and $\delta$ Lyrae can be seen as clearly separated. The distance, according to Auwers, 1682, is 208". The fact that each of these stars is itself double was verified by Christian Mayer, and in 1823 John Herschel discovered three other very faint stars between $\epsilon$ and $\delta$ Lyrae. The distance of the two components from $\epsilon$ is, according to Dembowski, 1863, 3.045". The distance of both stars from $\delta$ Lyrae was in the same year 2.48", and seems to be slowly decreasing. From their common proper motion these seem to constitute a physical system of vast dimensions.
18 41	+ 37 39	$\zeta$ <b>Lyrae</b> . A star of 4 mag., with a companion 5.5 mag.; distance 44", recognised by Flamsteed. Burnham discovered further three very feebly shining companions, which can be discerned only in the most powerful telescopes.
18 42	- 5 49	<i>R</i> <b>Scuti Sobieski</b> . Recognised as variable by Pigott in 1795. The change of brilliancy is very irregular; at maximum the star is sometimes 4.5 mag., though it is often under 5.5 mag.; at minimum it is 6, sometimes 8 mag. The period is irregular. The spectra seem, according to the Rev. T. E. Espin, also to vary considerably.

Right Ascension, 1900.		Declination, 1900.		
h.	m.	°	'	
18	41	+	20 27	110, <b>Herculis</b> , 5 mag., with a companion 11 mag., d. = 61", p. = 92°. Burnham saw a still fainter companion, d. = 45", p. = 96°.
18	43	+	60 56	Σ 2403, <b>Draconis</b> , 6 mag., with a companion 9 mag. According to Struve, in 1832, d. = 1.9", p. = 259°.
18	46	-	6 23	4437 (6705), <b>Star Cluster in Scutum Sobieski</b> . Discovered by Kirch in 1681, and described later by Messier as a cluster of small stars only visible with a good instrument. The stars can be clearly seen with a 3½-inch refractor. Lamont and Helmert have taken the measurements of the whole cluster by trigonometry.
18	46	+	33 15	<b>β Lyrae</b> . This variable possesses five companions: B 6.7, C 13, D 14, E 9.2 mags. The following positions have been determined (1895):— A B, d. = 45.7", p. = 149      A E, d. = 67.2", p. = 318 A C, d. = 47.1", p. = 248      A F, d. = 86.3", p. = 19 A D, d. = 64.3", p. = 68
				The principal has a range of variability between 3.4 mag. and 4.5 mag., its period being 12 days 21 <sup>h</sup> 47 <sup>m</sup> 23 <sup>s</sup> . From minimum it reaches its first maximum of light in 3 days 2 hours; it then decreases in 3 days 7 hours by half a magnitude, returning in 3 days 3 hours to the intensity of its first maximum, and finally falls to its chief minimum in 3 days 9 hours. The spectrum of this star shows broad dark and bright hydrogen lines, as well as lines of magnesium and of the Cleveite gases. These lines are subject to periodical shifting, from which it is evident that β Lyrae is a very close double star, incapable of separation in any telescope, and that the variability is due to the mutual interpositions of β and its spectroscopic companions. The stars must be at least some 442 millions of miles asunder, and their masses are 27 times as great as that of our sun.
18	46	+	10 14	4440 (6709), <b>Star Cluster in Aquila</b> . A beautiful object, consisting of stars 9 to 12 mag. Vogel has measured 62 of them with the micrometer.
18	48	-	8 50	4441 (6712), <b>Nebula in Scutum Sobieski</b> . Brilliant, large, and nearly circular, more condensed towards the centre. According to Herschel, it is resolvable into stars.
18	49	-	30 36	4442 (6715), <b>Nebula in Sagittarius</b> . Discovered by Messier in 1778, and described as a faint nebula with a brilliant centre. According to Herschel, it is a globular star cluster consisting of very minute stars.
18	50	+	59 16	ο <b>Draconis</b> , 4.5 mag., of a yellowish colour, with a companion of 7.6 mag., at d. = 31.0", p. = 341° (1863).
18	50	+	32 54	4447 (6720), <b>Nebula in Lyra</b> . The beautiful and easily observed Ring nebula. Discovered by Darquier at Toulouse, 1779, between β and γ Lyrae. He describes it as very delicate, with well-defined boundaries, of about the same size as Jupiter, and looking like a planet that is about to become extinct. Messier describes it as a luminous cluster, apparently composed of small stars. It is, indeed, remarkable that this nebula, which appears like a disc with a bright border, has a brilliancy wherein one fancies one can see twinkling star-points. Rosse and Bond maintain that they have succeeded in resolving it into separate stars, but its spectrum is one of bright lines, which indicate that it is really composed of incandescent

Right Ascension 1900.	Declination 1900.
18 51	+ 4 4
18 51	+ 33 49
18 52	+ 43 49
18 55	+ 13 30
18 56	- 13 18
19 0	- 4 11
19 2	+ 8 5
19 4	+ 32 20
19 3	+ 4 34
19 10	+ 38 58
19 12	- 1 6
19 13	+ 30 0
19 13	+ 37 57
19 14	+ 0 55
19 14	- 6 24

gas. A minute star, of 10 mag., follows the nebula closely. In the Liek refractor there was no trace of resolvability of this nebula, and the spectro-scope shows it to be a nebulous mass shining with its proper light. Kolar photographs indicate within the ring three dark and two bright streaks which are, however, invisible in the 36 inch telescope.

**$\theta$  Serpentis.** A yellowish-white star, 4 mag., with a somewhat faint companion at distance 22".

**Multiple Star in Lyra.** The primary, 6 mag., has a companion 6.5 mag.,  $d. = 45''$ ,  $p. = 351^\circ$ . Struve repeatedly observed this double star but Burnham in 1879 was the first to discover that the primary is itself double, there being near it a small star of 10 mag.,  $d. = 1.7''$ ,  $p. = 126^\circ$ .

**R Lyrae.** A variable star discovered by Baxendell in 1856, of a reddish colour. The change of brilliancy is but slight, the star varying between 4.0 and 4.7 within a period of 46 days.

11, **Aquilae,** 5.5 mag., and greenish-white, with a faint companion 9.2 mag., distance 18.7", position angle 242°. Discovered by W. Herschel, 25 June, 1781. An optical double star.

**Nova in Sagittarius, 1898.** This star was not visible at the end of 1897, or beginning of 1898, for there is no record of it in photographs taken about this time at the Harvard Observatory station in Arequipa, although these photographs contained stars up to the 15 mag. It appeared first in a photograph of the 8 March, 1898, as of 4 mag., but decreased in brilliancy rapidly, so that on April 19 it was only of 8.2 mag. Bright hydrogen lines, as well as dark lines, were found in its spectrum. With the decrease in its brilliancy these lines gradually vanished, and finally the spectrum showed nothing more than the principal line of gaseous nebulae.

15, **h Aquilae.** Two stars 6 mag., distance 35", recognised as a double star by Bradley.

**R Aquilae.** A variable star of a deep red colour. At maximum it is sometimes 6.5 mag., at minimum 11 mag. Period 351 days.

17, **Lyrae.** A yellowish star, 6 mag., with a companion 10 mag.,  $d. = 3.7''$ ,  $p. = 331^\circ$ .

4470 (6755), **Star Cluster in Aquila.** Fairly large, rich, somewhat dense, diameter 12' to 15'. Discovered by W. Herschel, 30 July, 1785. The stars range from the 12 to the 14 mag.

$\eta$  **Lyrae.** A blueish star 4.5 mag., with a companion 8 mag.,  $d. = 28''$ ,  $p. = 85^\circ$ .

4482 (6775), **Star Cluster in Aquila,** consisting of stars from 9 to 12 mag., discovered by W. Herschel.

4485 (6779), **Star Cluster in Lyra.** Discovered by Messier 23 January, 1779, as a starless nebula in Lyra. In 1784 Herschel resolved it into stars. It appears dull in a 3 $\frac{1}{2}$ -inch refractor; 4' to 5' in diameter.

$\theta$  **Lyrae,** 4.5 mag., with a companion 9.5 mag.,  $d. = 101''$ ,  $p. = 70^\circ$ .

23, **Aquilae,** 5.5 mag., yellowish, with a faint companion 9.5 mag.,  $d. = 3.4''$ ,  $p. = 11^\circ$ .

4487 (6781), **Nebula in Aquila.** Fairly large, round, of moderate brilliancy. According to Rosse it is of spiral arrangement.

Right Ascension, 1900.		Declination, 1900.			
h.	m.	°	'		
19	15	-	0	19	<b>Nova in Aquila, 1899.</b> In photographs taken at Cambridge [U. S.] in April, 1899, Mrs. Fleming discovered a star of 7 mag., which previous to this had not been visible. Its light quickly diminished in brightness, and about the middle of 1900 it was a star of only 11 mag., having the appearance of a small nebula.
19	17	+	18	57	$\Sigma$ 2504, <b>Vulpeculae</b> , 6.5 mag., with a companion 8 mag., d. = 9".
19	25	+	24	28	6 <b>Vulpeculae</b> , appearing to the naked eye like a star of 4 mag. In reality 2 stars of 4 and 5 mags., d. = 403".
19	27	+	27	45	$\beta$ <b>Cygni</b> . A reddish-yellow star, 3 mag., with a blue companion 5 mag., distance 34". The primary is variable, but the variations of brightness are not important; the colour also varies slightly. Huggins photographed the spectra of $\beta$ and its companion separately, from which it appeared that the principal had a spectrum of Class II., and its companion that of Class I.
19	34	+	49	59	$\zeta$ <b>Cygni</b> , 5 mag., with two companions, B = 14 mag., C = 10.3 mag. The former discovered by Burnham, and the latter by O. Struve. A B, d. = 3.4", p. = 49°; A C, d. = 42.3", p. = 183°.
19	33	+	16	14	$\epsilon$ <b>Sagittae</b> , 5.5 mag., with a companion 8 mag., d. = 92", p. = 81°.
19	34	+	49	58	$\delta$ <b>Cygni</b> . Of a deep red colour, at maximum 6 mag., at minimum very faint (being 14 mag.). Recognised as variable by Pogson in 1852. The period is, at least, 426 days.
19	35	-	16	34	54, <b>Sagittarii</b> , 6 mag., with a companion 7.5 mag., d. = 46", p. = 42°; and another very faint companion, discovered by Burnham, d. = 36", p. = 245°.
19	37	+	26	35	4508 (6815), <b>Star Cluster in Vulpecula</b> . Very large, fairly rich in stars, not very dense. The stars range from 9.5 to 12 mag.
19	38	+	11	35	$\chi$ <b>Aquilae</b> , 6 mag., with a companion 7 mag., distance only 0.6".
19	38	-	14	24	4510 (6818), <b>Nebula in Sagittarius</b> . A planetary nebula, discovered by Herschel 8 August, 1787. He describes it as small, decidedly nebulous at the edges, and of uniform brightness, 10" to 15" in diameter. Several small stars are visible near to it. The spectrum contains three bright lines, and, according to Keeler's measurements, the nebula is approaching our sun at the rate of a mile per second.
19	38	+	39	57	4511 (6819), <b>Star Cluster in Cygnus</b> . A large and rich cluster, discovered by Harding in 1827. The stars are of 10 to 12 mag.
19	39	+	50	18	16, <b>Cygni</b> . Two stars of 5.5 mag., distance 37".
19	42	+	44	53	$\delta$ <b>Cygni</b> . A greenish star, 3 mag., with a companion 8 mag., first seen by W. Herschel, 1783. Later, the companion could no longer be distinguished, till Struve saw it again in 1826. According to Hall, the distance in 1890 was 1.5", position angle 310°.
19	42	+	50	17	4514 (6826), <b>Nebula in Cygnus</b> . Discovered by W. Herschel, 6 September, 1773. In small telescopes it looks like a star out of focus. Secchi has made a drawing of this nebula. According to Keeler, this nebula is receding from the sun at the rate of 7.4 miles per second.
19	43	+	33	30	17, <b>Cygni</b> . A reddish star, 5 mag., with a blueish companion 8 mag., distance 26", position angle 73°.
19	44	+	11	34	$\pi$ <b>Aquilae</b> , 6 mag., with a companion 7 mag., distance 1.5".

Bright Apparition 1900.	Declination 1900.
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19 43	+ 27 4
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11. **Nova Vulpeculae.** At this spot there appeared in 1670 a star of 3 mag., which disappeared in the autumn of the same year; in 1671 it reappeared as a star of 4 mag., but again vanished; was again seen in 1672, and is now completely invisible. In 1852 Hind discovered a small star of 10.5 mag., which in 1861 had diminished to 12 mag., and which he held to be identical with the star of 1670. It seemed to him somewhat blurred as compared with other stars in its vicinity, and this impression was shared by Talmage and Baxendell.

19 45	+ 18 53
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ζ **Sagittae.** A greenish-white star, 5.6 mag., with a companion 9 mag., d. = 8.8", p. = 309". Clark, in 1875, with a 12-inch refractor, found the primary to be itself double. A very difficult object. Burnham's measurements are d. = 0.1", p. = 183" (1891). Period 18.7 years.

19 46	+ 8 36
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α **Aquilae, Altair.** A brilliant star, 1 mag., with a beautiful spectrum (Vogel's Class Ia.). The hydrogen lines appear much broadened and frayed at the edges, which Vogel ascribes to special temperature and pressure conditions, as well as to the rapid rotation of the star. From Vogel's photo-spectroscopic researches and measurements, this star is approaching the sun at the rate of some 22 miles per second. There is a companion 10 mag., d. = 152", p. = 322". There are several fainter stars nearer to the primary. Burnham saw over a dozen with his great refractor.

19 47	+ 32 40
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χ **Cygni.** A variable star of long period, with irregular variations in brightness. Its variability was discovered by Kirch in 1686. At maximum the star reaches 4 mag., at minimum it diminishes to 13 mag. The period is about 406 days.

19 47	+ 0 45
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η **Aquilae.** Recognised as variable by Pigott in 1784. At maximum it is 3.5, at minimum 4.7 mag. The period of 7 days 11.42" is at present slowly increasing.

19 47	+ 59 10
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1517 (6832), **Star Cluster in Cygnus.** A fairly large but not very dense cluster, containing stars of 7 mag.

19 49	+ 18 31
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1520 (6838), **Star Cluster in Sagitta.** Described by Messier as a faint nebula. Herschel resolved it into a dense cluster of stars, 3' in diameter. A beautiful object.

19 49	+ 70 0
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ε **Draconis,** 4.5 mag., with a companion 7.6 mag., d. = 28", p. = 30".

19 49	+ 6 10
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β **Aquilae.** A star of 4 mag., pale red in colour, with several faint stars near to it. Burnham gives the following measurements for two of them (1880):—

A B, d. = 11.7", p. = 15.7"      A C, d. = 151.7", p. = 347.2"

B, according to Engelmann, is 11.4 mag. C is more brilliant.

19 49	- 8 29
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57, **Aquilae,** 5 mag., with a companion 6 mag., distance 36". Struve calls both stars white, but at present one star seems to be yellowish, the other gives a greenish light.

19 53	+ 34 49
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η **Cygni.** A star of 4.5 mag., with 4 companions: B 13, C 12, D 12.5, E 12.5 mags.; C and D discovered by W. Herschel, B and E by Burnham. Burnham gives (1899) the following positions of the companions:—

A B, d. = 7.2", p. = 208"      A D, d. = 49.7", p. = 168"

A C, d. = 46", p. = 326"      A E, d. = 61.7", p. = 247"

Right Ascension, 1900.	Declination, 1900.	
19 53	+ 52 11	↓ <b>Cygni</b> . A white star of 5 mag., with a companion 7.5 mag., d. = 3.3", p. = 185° (1831).
19 55	+ 22 27	4532 (6853), <b>Nebula in Vulpecula</b> . Rosse's "Dumb-bell Nebula." First discovered in 1764, and described by Messier as an oval, starless nebula. A 4-inch refractor shows two contiguous nebulae of moderate brilliancy, surrounded by some stars. The great telescopes of the two Herschels showed no more than this. The best drawing seems to be that of Secchi, who recognised the existence of a multitude of stars between the two nebulae. According to Huggins these latter give a spectrum of bright lines, and are therefore really masses of incandescent gas. Roberts' photograph in 1888, taken in an exposure of three hours, indicates the completeness of the oval bright border of the disc.
19 55	+ 17 13	13, <b>Sagittae</b> , 6 mag., with a companion 7.5 mag., d. = 340", p. = 13°.
19 58	+ 24 39	16, <b>Vulpeculae</b> . Two stars of 6 mag., at distance of only 0.6" from one another. They can be resolved in none but the largest telescopes.
19 59	+ 49 49	ε <b>Cygni</b> , 4 mag., of a yellowish colour, with a companion of 8 mag., d. = 42", p. = 146°; also a second companion of 11 mag., d. = 9", p. = 74°. The latter was discovered by Burnham.
20 0	- 22 12	4543 (6864), <b>Nebula in Sagittarius</b> . Discovered by Méchain in 1780 as a starless nebula. But even Messier recognised stars in it, and W. Herschel resolved the whole into a star cluster.
20 1	+ 43 43	4544 (6866), <b>Star Cluster in Cygnus</b> . Large, 15' in diameter, very rich in stars of considerable brilliancy and very dense. Discovered by W. Herschel, 11 September, 1789.
20 3	+ 9 6	Σ 2628, <b>Aquilae</b> . Yellowish, 6 mag., with a reddish companion 8 mag., d. = 4.5", p. = 349°. No motion has been observed in the companion since the time of Struve.
20 6	+ 20 37	θ <b>Sagittae</b> , 6 mag., with a companion 8 mag., d. = 11.4", p. = 326°; and a second companion 7.5 mag., d. = 70.5", p. = 227°.
20 7	+ 0 34	Σ 2644, <b>Aquilae</b> . A double star, 6 and 7 mags., d. = 3.6", p. = 208° (1880). The primary is of a blueish-white colour.
20 8	+ 26 11	4559 (6885), <b>Star Cluster in Vulpecula</b> . A not very dense cluster of moderate brilliancy, fairly rich in stars, some of 6 to 13 mag. Schultz at Upsala has obtained accurate measurements of this cluster.
20 10	- 3 49	Σ 2654, <b>Aquilae</b> . A star of 6.5 mag., with a companion 8 mag., d. = 14", p. = 234°.
20 10	+ 46 26	σ <sup>3</sup> , <b>Cygni</b> . A star of 4 mag., with a companion 5.5 mag., d. = 338", p. = 324°; a second companion 6.5 mag., d. = 107", p. = 174°; a third companion 11.5 mag., d. = 20", p. = 333°.
20 12	- 12 50	α <sup>1</sup> , α <sup>2</sup> , <b>Capricorni</b> . Two stars, 3 and 4 mag., both yellowish, distance 376". Each of them is itself double; α <sup>2</sup> has a companion 10.5 mag., d. = 7.4", p. = 150°. This companion again was found to be also double by Clark in 1862, and consists of two stars of 11 mag., distance only 1.2". They can be divided by the very largest telescopes only. There is a third star (9 mag.), d. = 154", p. = 156°. The star α <sup>1</sup> has near it a star of 9.5 mag., d. = 44.3", p. = 221°. Burnham found also a small star of 13 mag., d. = 43", p. = 182°, but this was only visible in the 26-inch refractor at Washington.

Right Ascension 1800.	Declination 1800.	
$\alpha$ m		
20 14	+ 37	43 $\beta$ <i>Cygni</i> . A star of 6 mag., which suddenly increased in the year 1600 to 3 mag., disappeared in 1621, but was again seen in 1657 by Cassini as a star of 3 mag.; it then again disappeared. Since 1657 it has been 6 mag. without variation. It gives a yellowish light. Its spectrum is especially interesting, containing as it does bright lines among them hydrogen lines and D <sub>3</sub> .
20 14	- 19	26 $\sigma$ <i>Capricorni</i> . A star of 5.5 mag., with a companion 8.5 mag., d. = 56". Seen by Herschel.
20 13	+ 77	24 $\kappa$ <i>Cephei</i> ( $\Sigma$ 2675). Greenish-white, 4 mag., with a companion, 8 mag., d. = 7.3", p. = 124°.
20 15	- 15	6 $\beta$ <i>Capricorni</i> , 2.5 mag., and of a golden yellow, with a blueish companion 6 mag., distance 205". Between the two stars, somewhat to the north of a line joining them, is a star of 11 mag., which, as discovered by J. Herschel, is itself double, and consists of two stars of 11.5 mag., distance 3". In Herschel's opinion no telescope can distinguish the moons of Uranus if it cannot make these two stars clearly visible. Burnham found in 1883 that one of these stars is a double: distance = 0.8".
20 18	+ 19	47 4572 (6905), <i>Nebula in Sagitta</i> . Planetary, but described by J. Herschel as capable of being resolved into stars. Lamont speaks of it as a circular mass of nebula having a distinct nucleus in the centre, but without any trace of resolvability. The nucleus was not visible in Herschel's telescope. The nebula is placed between a number of stars. Spectrum—a bright nebulous line of the same refrangibility as the brightest of the lines of nitrogen. —HERGINS.
20 19	+ 39	56 $\gamma$ <i>Cygni</i> , 2.5 mag., with 2 companions discovered by Burnham, of 10.4 mag., d. = 1.8", p. = 302°, d. = 141", p. = 196°, respectively. The former of the companions can be seen only in the most powerful telescopes.
20 20	+ 40	27 4575 (6910), <i>Star Cluster in Cygnus</i> . A moderately rich but rather small cluster containing stars of 10 to 12 mag., besides several more brilliant.
20 22	- 18	32 $\pi$ <i>Capricorni</i> . A somewhat yellowish star of 5 mag., with a faint companion 9 mag., d. = 3", p. = 146°, discovered by Burnham.
20 23	- 18	9 $\rho$ <i>Capricorni</i> , 5 mag., with a companion 7 mag., d. = 3", p. = 174°. There is also a distant companion 7.5 mag., d. = 236", p. = 151°.
20 24	- 18	55 $\omicron$ <i>Capricorni</i> , 5.6 mag., with a companion 7 mag., distance 22". Recognised as a double star by Bradley.
20 27	+ 48	37 $\omega^2$ <i>Cygni</i> , 5 mag., with a companion of 10 mag., d. = 56.4", p. = 86°. Burnham discovered another extremely feeble companion at d. = 18", p. = 342°.
20 28	+ 25	28 $\Sigma$ 2695, <i>Vulpeculae</i> . The primary is 6 mag., and white, the companion 8 mag. The position of the latter, according to Perrot in 1884, d. = 1.2", p. = 82°.
20 29	+ 7	4 4586 (6934), <i>Nebula in Delphinno</i> . Faint, somewhat brighter towards the centre. A star of 9 mag. precedes it. W. Herschel resolved the nebula into stars.
20 29	+ 60	18 4590 (6939), <i>Star Cluster in Cepheus</i> . A beautiful, rich star cluster from 8' to 9' in diameter. Discovered by Herschel 9 September, 1798.

Right Ascension, 1900.	Declination, 1900.		
h. m.	°	'	
20 30	+ 27	58	4591 (6940), <b>Star Cluster in Vulpecula</b> . Discovered by W. Herschel, brilliant, fairly large and rich, containing many brilliant stars densely massed together.
20 33	+ 31	13	<b>A Star in Cygnus</b> of 6 mag., with a companion of the same mag., at d. = 178", p. = 175°.
20 33	+ 14	15	$\beta$ <b>Delphini</b> . A greenish star of 3 mag., with a faint companion 11 mag., d. = 37", p. = 331°. There is a second exceedingly faint (13 mag.) companion, d. = 25.9", p. = 118°. Finally, Burnham found the primary to be itself double, consisting of two stars at a distance of only 0.7", of which the period of revolution has been calculated as 26.7 years.
20 34	+ 0	8	<b>1, Aquarii</b> . A star of 5.5 mag., with two very faint companions (11 mag.), whose positions Burnham observed in 1879 as follows: d. = 55.8", p. = 217.4°; d. = 72.9", p. = 38.9°.
20 35	+ 15	33	$\alpha$ <b>Delphini</b> , 4 mag., with a companion 9.5 mag., d. = 35", p. = 278°. There are, in addition, three exceedingly faint stars near the primary, d. = 20", p. = 225°; d. = 45", p. = 350°; d. = 81", p. = 114°. Auwers in 1858 found, from numerous comparisons, that $\alpha$ fluctuates in brilliancy to the extent of about half a magnitude within a period of about 14 days. Since the date named this change of brilliancy does not seem to have been again noticed.
20 37	+ 31	57	49, <b>Cygni</b> , 6 mag., and yellowish, with a blueish companion 8 mag., distance 2.7". In both stars the colours are easily recognisable.
20 41	+ 16	2	<b>T Delphini</b> . Variable, discovered by Baxendell in 1860. At maximum it does not exceed 8, and often scarcely 9 mag., at minimum it is 13 mag. Period 332 days.
20 42	+ 30	21	4600 (6960), <b>Nebula in Cygnus</b> . A remarkable, irregular nebula, fairly bright and large. It extends beyond 52 Cygni. Discovered by Herschel 7 September, 1784; as seen by him it extended over more than 1°; indeed, with the highest magnifying power, almost 2°. The spectrum, according to Huggins, is a continuous one.
20 42	+ 15	46	$\gamma$ <b>Delphini</b> . A star of 4 mag., golden yellow in colour, with a greenish-blue companion 5 mag., distance 12". A second companion at d. = 140", p. = 11°.
20 42	+ 30	21	52, <b>Cygni</b> . Yellowish, 4 mag., with a companion 9 mag., d. = 6.6", p. = 61° (1877).
20 43	+ 61	24	$\eta$ <b>Cephei</b> . A star of 3.5 mag., with a companion of 12 mag., at d. = 101", p. = 34°. From spectro-photographs and measurements at the Lick Observatory, the principal is moving in the direction of the sun at the rate of 54.25 miles per second.
20 43	+ 34	0	<b>T Cygni</b> . Recognised as variable by Schmidt in 1864; it is usually about 6 mag., and yellowish-white in colour. The changes of brilliancy are slight but unmistakable.
20 44	+ 36	8	$\lambda$ <b>Cygni</b> , 5 mag., with a companion 10.5 mag., distance 85", position angle 104°. Struve discovered that the primary is itself double, consisting of two stars of 5.5 mag., distance 0.7". A very difficult object.
20 45	- 5	31	<b>T Aquarii</b> . Recognised as variable by Goldschmidt in 1861. At maximum it is often somewhat above 7 mag., but at minimum it diminishes to 13 mag. Period 203 days.



Right Ascension 1900		Declination, 1900.			
h.	m.	°	'		
20	46	-	6	0	4, <b>Aquarii</b> ( $\Sigma$ 2729). A very difficult double star. The primary is 6 mag., and somewhat yellowish, the companion 8 mag. According to Hall (1887), the distance is only 0.5", position angle 176°.
20	48	-	12	55	4608 (6981), <b>Star Cluster in Capricornus</b> . Discovered by Méchain as a faint nebula. Messier, too, observed it, and remarked a small telescopic star close to it. Herschel, in 1783, resolved the nebula into stars, and the 40-foot reflector, 4 October, 1810, with a magnifying power of 280, showed separate stars even in the centre of the cluster. It is nearly 2' in diameter. Several other stars appeared in the field of vision, but they were, as Herschel remarked, quite distinct from the minute points of light to be found in the cluster itself.
20	51	+	4	9	$\Sigma$ 2735, <b>Equulei</b> . A star 6 mag., with a companion 8 mag., d. = 2", p. = 290°.
20	54	+	3	55	1, $\epsilon$ <b>Equulei</b> . A yellowish star of 5 mag., with a blueish companion 7 mag., distance 10.8". The primary, as discovered by Struve, is a narrow double star of 5.7 and 6 mags., distance, according to Engelmann (1884), 1.26".
20	57	+	15	48	4625 (7006), <b>Nebula in Delphinus</b> . Fairly brilliant, not large, round, brighter at the centre.
20	56	+	47	8	59, <b>Cygni</b> , 5 mag., with a companion 9 mag., d. = 20", p. = 352°.
20	57	+	6	47	2, <b>Equulei</b> . Two stars of 6 mag., distance 2.6". No perceptible change has been observed in their relative positions during the last fifty years.
20	57	+	47	8	59, $\rho^1$ <b>Cygni</b> . A star of 5 mag., greenish-white, with a companion 9 mag., d. = 20", p. = 352°; there is also a second companion 10.5 mag., d. = 26.7", p. = 141°.
20	58	+	1	8	$\Sigma$ 2744, <b>Equulei</b> . A star of 6 mag., with a companion 7 mag., distance 1.5".
20	59	-	11	45	4628 (7009), <b>Nebula in Aquarius</b> . A beautiful, planetary nebula, discovered by W. Herschel, 7 September, 1782. The disc appears to be somewhat blurred at the edges in a telescope of medium strength. Lassell saw a bright ring within the nebula, and Rosse calls it "Saturn nebula." The spectrum, according to Huggins, shows it to be of a gaseous nature. Vogel also finds the three bright lines in it. According to measurements made by Keeler, this nebula is moving towards the sun at the rate of 17.2 miles per second.
20	59	-	6	13	12, <b>Aquarii</b> , 6 mag., with a companion 8 mag., d. = 3", p. = 190°.
21	0	+	23	25	<b>R Vulpeculae</b> . A variable star, which at maximum seldom reaches 7.5 mag., and at minimum disappears even in the most powerful telescopes. Period nearly 137 days. Discovered at Bonn in 1858.
21	1	+	38	13	61, <b>Cygni</b> , 5 mag., with a companion 6 mag., both golden yellow in colour, but of slightly different tints. The distance is 21", and the change of position is rapid; it has not yet been possible, however, to calculate the period of revolution. This was the first star of which Bessel (1838) was able to measure the parallax, and to deduce therefrom its distance from the earth. The measurements have been repeated later by several observers, but without establishing a satisfactory correspondence with each other or with Bessel. From photographs taken by Professor Wilsing, at Potsdam, it was at length seen that the cause of these differences arose from the fact

Right Ascension. 1900.	Declination. 1900.
h m	° ' "
21 3	+ 41 50
21 6	+ 9 44
21 8	+ 45 16
21 8	+ 68 5
21 9	+ 59 34
21 10	+ 9 36
21 11	+ 37 36
21 14	+ 34 28
21 17	+ 58 12
21 18	+ 19 23
21 18	+ 6 23
21 25	+ 11 44

that the principal of 61 Cygni has a slight periodical motion, probably around a darker companion. Keeping this circumstance in view, the probable parallax has been fixed at  $0.36''$ , corresponding to a distance from the earth of 550,000 radii of the earth's orbit.

(7027), **Nebula in Cygnus**. Recognised by Webb, 14 November, 1879, as a star of 8.5 mag., surrounded by nebula. Schmidt describes the nebula as elongated in shape, being  $8''$  to  $10''$  in length, condensed towards the centre, which seems of a stellar nature. Vogel finds the spectrum to contain the three bright lines very clearly marked, the rest of the spectrum being faint and continuous. From measurements made by Keeler, this nebula is receding from us at the rate of 16.8 miles per second.

$\gamma$  **Equulei**, 4.5 mag., yellow, with a companion 6 mag., distance  $366''$ . The primary is itself double, having a small star 10 mag. at  $d. = 2.1''$ ,  $p. = 277^\circ$ . Burnham also saw a very faint star,  $d. = 44''$ ,  $p. = 79^\circ$ .

4645 (7039), **Star Cluster in Cygnus**. An extensive but not very rich cluster of stars of 10 mag. A star of 7 mag. follows it on its edge.

$T$  **Cephei**. Recognised as variable by Ceraski in 1879. At maximum the star is 5.5, at minimum 9 mag. Period 383 days.

$\Sigma$  2780, **Cephei**. The primary is 6, the companion 7 mag., and both are white. Wilson (1873):  $d. = 1.0''$ ,  $p. = 229^\circ$ . No change of position has been observed since the time of Struve.

$\delta$  **Equulei**, 4.5 mag., and yellowish, with a companion 10 mag. In 1852 Otto Struve found that the primary is itself double, having a companion 10.5 mag. near to it. Burnham (1881):—

A B,  $d. = 0.35''$ ,  $p. = 29.0^\circ$

A C,  $d. = 22.7''$ ,  $p. = 37.9^\circ$

The primary can only be divided with a most powerful instrument. The period of the two is 11.5 years.

$r$  **Cygni**, 4.5 mag.; a difficult double star, discovered by Clark in 1874. According to Burnham, the companion is at  $d. = 1''$ . Period 36.5 years. Holden saw another very faint companion,  $d. = 16''$ ,  $p. = 260^\circ$ .

$v$  **Cygni**. A star of 4.5 mag., with two faint companions of 10 mag.,  $d. = 15''$ ,  $p. = 219^\circ$ ; and  $d. = 21.5''$ ,  $p. = 178^\circ$ .

$\Sigma$  2790, **Cephei**, 5.6 mag., and red, with a companion 10 mag.,  $d. = 4.5''$ ,  $p. = 46.5^\circ$ .

1 **Pegasi**. A yellow star, 4.5 mag., with a companion 8.6 mag.,  $d. = 37''$ ,  $p. = 301^\circ$ . There is no change of position since 1780. The principal itself, according to Campbell (1899), is a spectroscopic double, with a period of revolution of about 10 days.

$\beta$  **Equulei**, 5 mag., with a companion 10.5 mag.,  $d. = 67.4''$ ,  $p. = 309^\circ$ , and, in addition, a second companion 11 mag.,  $d. = 86''$ ,  $p. = 276^\circ$ . The first companion is itself a double star of 10.5 and 11 mags.,  $d. = 6.5''$ ,  $p. = 10^\circ$ . Burnham also found a very faint star,  $d. = 32''$ ,  $p. = 260^\circ$ . This latter is visible in a very powerful telescope only.

4670 (7078), **Star Cluster in Pegasus**. Recognised as a nebula by Maraldi as far back as 1745. Herschel resolved it into a globular cluster

Right Ascension, 1900.		Declination, 1900.		
h	m	°	'	
21	28	-	1 16	of stars. With a 5-inch refractor it has this appearance, though the centre cannot be resolved. At the edges are scattered a large number of stars of from 11 to 12 mag. Diameter 3' to 4'. 4678 (7089), <b>Nebula in Aquarius</b> . In the average telescope this appears to be of moderate brilliancy and circular, with a small faint star at the eastern edge. Discovered in 1746 by Maraldi, was resolved into stars by Herschel.
21	28	+	70 7	$\beta$ <b>Cephei</b> . A greenish-white star of 3 mag., with a companion 8 mag., d. = 13.6", p. = 250°.
21	29	+	47 59	4681 (7092), <b>Star Cluster in Cygnus</b> . A large and beautiful cluster, discovered by Messier in 1764; visible in a small telescope.
21	33	+	6 10	3, <b>Pegasi</b> . A star of 6 mag., with a companion 7.5 mag., d. = 39", p. = 349°. No change of position has been noticed since it was first observed by W. Herschel.
21	35	-	23 38	4687 (7099), <b>Star Cluster in Capricornus</b> . Described by Messier as a strip of starless nebula visible only with difficulty. It can be resolved into stars with a 5-inch refractor. Herschel saw the stars with a 10-foot reflecting telescope. It is of a spiral form, according to Rosse.
21	36	+	57 2	$\Sigma$ 2816, <b>Cephei</b> . Triple, with a distant companion. The primary A is 6 mag., B 14, C 7, D 7. Burnham (1890):— A B, d. = 1.6", p. = 324° A C, d. = 11.9", p. = 120° A D, d. = 19.9", p. = 340°
21	37	+	78 10	$S$ <b>Cephei</b> . A red star recognised as variable by Hencke in 1855. At maximum it never exceeds 7.5 mag., and at minimum it diminishes to 12 mag. Period about 484 days.
21	38	+	42 23	<b>Nova Cygni</b> . Discovered 24 November, 1876, by Schmidt, as a yellow star of 3 mag. It was at once apparent that a decrease of brilliancy was taking place, and in September, 1877, the star was only 10.5 mag.; in the following year it was only 13 to 14 mag., and invisible except in the most powerful telescopes. The spectrum at the time of greatest brilliancy contained eight bright lines indicating the presence of hydrogen, natrium, and magnesium. Finally these were reduced to a single bright line, accompanied by only the traces of a continuous spectrum, and bearing a close resemblance to the spectrum of a planetary nebula. Burnham (1892) estimates the mag. of the Nova at 13.5. At the Dunecht Observatory a sketch was made, by means of a 15-inch refractor, of the surroundings of Nova within a radius of 7.5'.
21	39	+	9 25	$\epsilon$ <b>Pegasi</b> . The primary is 2, the companion 8 mag. This latter was first seen by W. Herschel, 20 November, 1782. South (1825) gives the following measurements: d. = 138.5", p. = 323°. Burnham saw a companion 12 mag., at d. = 82", p. = 325°. According to Schmidt and Seidel, the primary seems to be variable in a slight degree.
21	40	+	28 18	$\mu$ <b>Cygni</b> . A star of 4.5 mag., with a beautiful blue companion 5 mag., distance 3.8", besides a companion of 7 mag., d. = 209", p. = 57°. Burnham saw another star of 11.5 mag., d. = 35", p. = 264°.

Right Ascension, 1900.		Declination, 1900.		
h.	m.	°	'	
21	40	+ 25	11	$\kappa$ <b>Pegasi</b> . A star of 4 mag., with a very faint companion 11 mag., d. = 11", p. = 308°. Burnham discovered that the primary is itself double, but the companion is only at distance 0.27". The two stars differ about half a magnitude in brilliancy. Period 11.4 years.
21	40	+ 58	19	$\mu$ <b>Cephei</b> . Of a deep red colour, and varies between 4 and 5 mag.; period not yet ascertained. It is of a fine deep garnet colour (W. Herschel). The star is a variable, with a range between 4 and 5 mag. Its spectrum, according to D'Arrest, is that of the most beautiful of Type III. The star has two companions, but they are both very faint.
21	44	+ 65	21	4709 (7142), <b>Star Cluster in Cepheus</b> . Fairly large, rich in stars, densely massed together. In large telescopes a very beautiful object.
21	49	+ 55	19	$\Sigma$ 2840, <b>Cephei</b> . A star of 6 mag., somewhat greenish in colour, with a companion 7 mag., d. = 20", p. = 195°.
21	56	+ 12	38	20, <b>Pegasi</b> , 6 mag. As discovered by Burnham, this star has an exceedingly faint companion of 13 mag., d. = 51", p. = 326°.
22	1	+ 64	8	$\xi$ <b>Cephei</b> . Primary yellowish, 4.5 mag., companion blueish, 6.5 mag. Struve, in 1831: d. = 5.6", p. = 289°.
22	1	+ 46	0	4755 (7209), <b>Star Cluster in Lacerta</b> . Large, fairly rich. Some of the stars are from 8 to 10 mag.
22	5	+ 58	47	$\Sigma$ 2872, <b>Cephei</b> . Primary 6 mag., companion 6.5 mag., d. = 21.7", p. = 316.4°. The companion is itself double, consisting of two stars of 7 mag., distance only 0.6".
22	9	- 21	35	41, <b>Aquarii</b> , 5.6 mag., and yellowish, with a companion 8.9 mag., d. = 5", p. = 116°.
22	8	+ 69	38	$\Sigma$ 2883, <b>Cephei</b> , 6 mag., with a blueish companion 8.2 mag., d. = 15", p. = 255°.
22	11	+ 49	23	4773 (7243), <b>Star Cluster in Lacerta</b> . Coarsely scattered, with a good many fairly brilliant stars; diameter 16'. In it is to be seen the double star $\Sigma$ 2890.
22	11	+ 72	49	$\Sigma$ 2893, <b>Cephei</b> . Yellowish, 5.5 mag. There is a star 7.5 mag., d. = 29", p. = 349°.
22	19	+ 20	20	33, <b>Pegasi</b> . Triple. The primary (A) 6; the nearer companion (B) 9; the farther (C) 7.5 mag. Dembowski gives the following measurements, 1863:— A B, d. = 2.3", p. = 178° A C, d. = 60.5", p. = 334°
22	24	- 0	32	$\zeta$ <b>Aquarii</b> ( $\Sigma$ 2909). Even Chr. Mayer knew this star to be double, and the fact is easily verified. The primary is 4, the companion 4.1 mag., d. = 3.5", and both are a greenish-white colour. Since Herschel's time, the distance has decreased, the position angle has also changed considerably.
22	25	+ 3	55	37, <b>Pegasi</b> . A star of 6 mag., with a companion 7 mag. When discovered by Struve (in 1831) the distance was 1.2", but it has since considerably decreased, and Burnham, in 1891, found it impossible to divide the star.
22	25	+ 57	54	$\delta$ <b>Cephei</b> . Yellowish-red in colour, and variable; it is the primary of a double-star system. At maximum it is nearly 4 mag., at minimum

h.	m.	Right Ascension, 1900.	Declination, 1900.	
				almost 5 mag. Period $5\frac{1}{3}$ days: the changes of brilliancy succeed one another quite regularly. Discovered by Goodricke.
22	31	+ 39	6	8, <b>Lacertae</b> . Quadruple, A = 6, B = 6.5, C = 10, D = 8.7 mag. Burnham's observations are— A B, d. = 22.3", p. = 186° B C, d. = 27.9", p. = 155° A D, d. = 81.5", p. = 148° B D, d. = 66.5", p. = 136°
22	33	+ 33	54	4815 (7331), <b>Nebula in Pegasus</b> . Fairly bright and large, with a sudden increase of brilliancy towards the centre. Spectrum continuous.
22	38	+ 29	42	$\eta$ <b>Pegasi</b> , 3.5 mag., with a companion 10 mag., observed by Herschel and South, d. = 91", p. = 339°. Burnham discovered that the companion is itself double; d. = 0.4", p. = 90°. Period 2.25 years (?).
22	42	- 14	35	69, <b>Aquarii</b> ( $\Sigma$ 2943). A star of 6 mag., with a companion 9 mag., d. = 28", p. = 115°.
22	42	+ 11	40	$\xi$ <b>Pegasi</b> , 4.5 mag., with a companion 11 mag. (observed by J. Herschel), d. = 12", p. = 118°. Burnham also saw a star of 11 mag., d. = 12", p. = 113°.
22	44	- 14	7	$\tau$ <b>Aquarii</b> , 4 mag., and red, with a companion 9.5 mag., distance 133".
22	51	- 20	59	$\delta$ <b>Aquarii</b> . A star of a deep reddish-yellow colour, recognised as variable by Argelander in 1853. At maximum it is only 8 mag., at minimum 12 mag. Period 280 days.
22	59	+ 27	32	$\beta$ <b>Pegasi</b> . The primary is variable; at maximum it is 2.2, at minimum 2.7 mag. The changes of brilliancy are somewhat irregular, and are accompanied by a change in the reddish tint of the star. The companion, which was observed by J. Herschel, is faint; and in 1878 the measurements were d. = 99", p. = 208°. It shows a beautiful spectrum of Class III. (with dark bands).
23	5	+ 74	51	$\pi$ <b>Cephei</b> . Observed by J. Herschel as a double star, but found to be triple by the refractor at Pulkowa, the primary being itself double. The central star is 5 mag. The farther companion 10 mag. The nearer companion is, according to Struve, 8.9 mag., distance 1.5".
23	11	- 9	38	$\psi$ <b>Aquarii</b> . An easily observed double star, recognised as such even by Chr. Mayer. According to Struve, the primary is 4.5 mag., and of a deep yellow colour. The companion is 8.5 mag., and blue. Distance 49.6". Burnham discovered that the companion is also a double, its fellow being of 9.6 mag., at d. = 0.22".
23	14	- 14	0	94, <b>Aquarii</b> ( $\Sigma$ 2998). Recognised as a double star by W. Herschel, 20 August, 1781. The primary is 6 mag. and yellowish-white, the companion 7 mag., and blue. The companion's change of position is slight, but the mutual motions of the stars show a physical relation between them.
23	15	+ 67	34	$\circ$ <b>Cephei</b> . The primary (deep yellow) is 5.5 mag., the companion (deep blue) 7.8 mag. The position of the companion seems to change. 1885, d. = 2.8", p. = 195°.
23	16	+ 8	22	$\delta$ <b>Pegasi</b> . A variable star, of a yellowish-red colour. At maximum it is occasionally 7 mag., but faint; at minimum it is only 13 mag. Period 318 days.

Right Ascension, 1900.		Declination, 1900.			
h.	m.	+	'		
23	20	+	61	3	4957 (7654), <b>Star Cluster in Cepheus</b> . Discovered by Messier 7 September, 1774, and described as follows: "A cluster of very small stars mingled with nebula. Can only be seen with an achromatic telescope." The cluster is preceded by two stars of 7 and 8 mags., and followed by one brilliant star. It contains one star of an orange colour.
23	21	+	41	59	4964 (7662), <b>Nebula in Andromeda</b> . A small, brilliant, planetary nebula; 15" in diameter, discovered by W. Herschel, 6 October, 1784. Lassell recognised in it a nucleus with two oval rings, Rosse a spiral arrangement. The spiral form of this nebula has been confirmed by the photographs taken by Deslandres. The spectrum contains four bright lines indicating a gaseous nature.
23	33	+	45	55	$\lambda$ <b>Andromedae</b> . A star of 4 mag., which, according to investigations made by Campbell at the Lick Observatory, is a spectroscopic double with a revolution period of 19.2 days.
23	39	-	15	50	<b>R Aquarii</b> . A star of a somewhat deep red colour, recognised as variable by Harding in 1811. It varies from 6 to 11 mag. Period apparently somewhat under 387 days.
23	41	-	19	14	107, <b>Aquarii</b> , 5.6 mag., with a blueish-white companion 7 mag., d. = 5.6", p. = 138°.
23	47	+	15	42	5023 (7742), <b>Star Cluster in Pegasus</b> . A cluster of coarsely scattered stars of 10 mag. and upwards.
23	52	+	56	10	5031 (7789), <b>Star Cluster in Cassiopeia</b> . Discovered by Caroline Herschel in 1783, between $\rho$ and $\sigma$ Cassiopeia. The stars are numerous but not brilliant, and the whole object is a beautiful sight in a powerful telescope.
23	53	+	50	50	<b>R Cassiopeiae</b> . Recognised as variable by Pogson in 1853, of a deep red colour. At maximum it is 5, at minimum 10.12 mag. The period is about 429 days.
23	54	+	55	12	$\sigma$ <b>Cassiopeiae</b> . Discovered to be double by W. Herschel, 31 August, 1780. The primary is 5.4 mag., and greenish, the companion 7.5, and deep blue in colour. The colours in both are very intense. The position of the companion does not seem to alter; d. = 3", p. = 324°.
23	54	+	33	9	$\Sigma$ 3050, <b>Andromedae</b> . Two stars 6 mag., distance 3".
23	57	+	26	34	85, <b>Pegasi</b> . This is a quadruple star, and one of the most interesting quadruples in the heavens. A = 6, B = 11, C = 9, D = 13 mags. Aitken furnishes (1899) the following measurements:—
					A B, d. = 0.8", p. = 226°
					A C, d. = 32.9", p. = 344°
					A D, d. = 83.9", p. = 288°

According to Burnham, the period of B is 25.7 years. The companions can be seen only in the great telescopes, the closest one only in a refractor of the first rank.

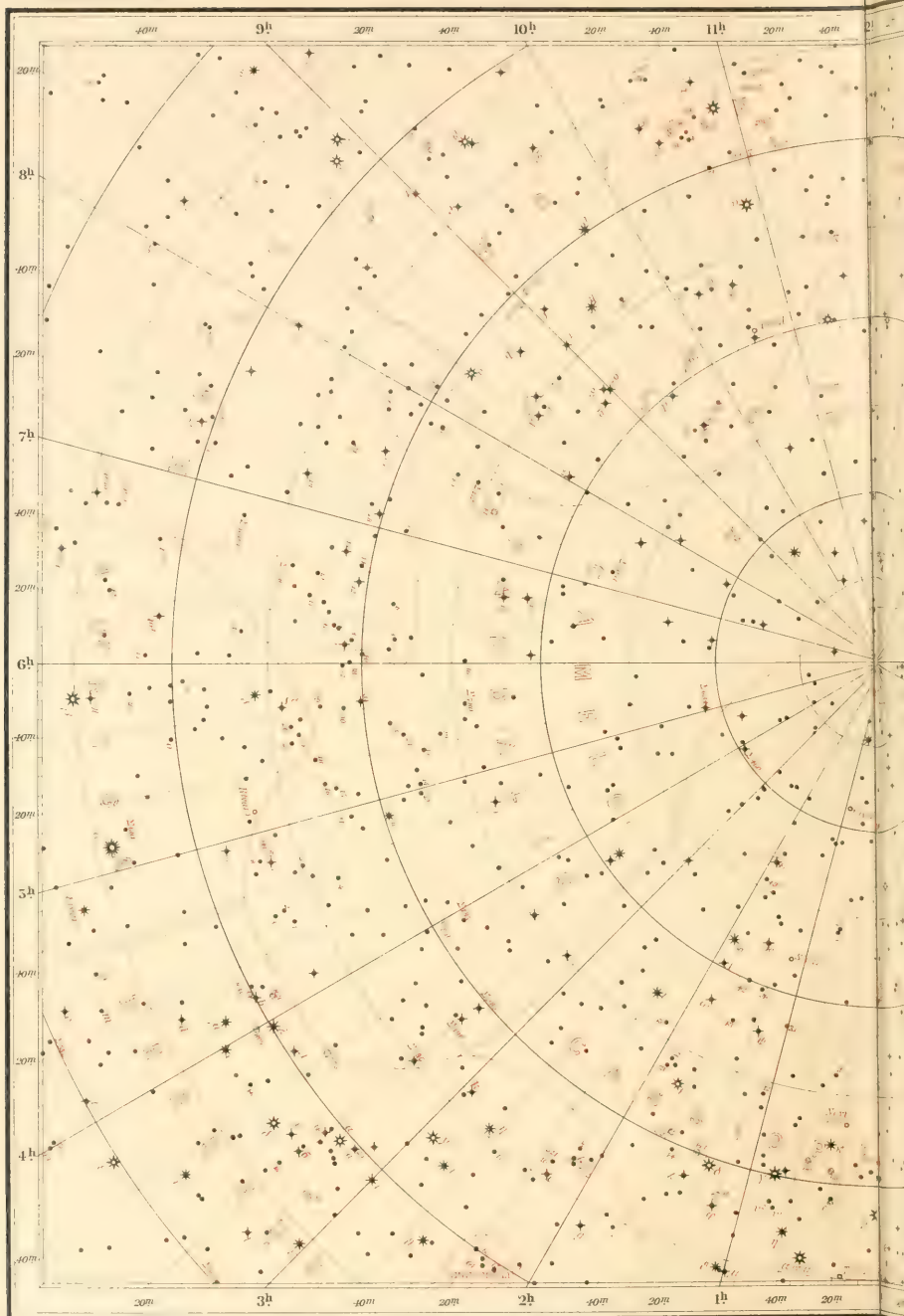
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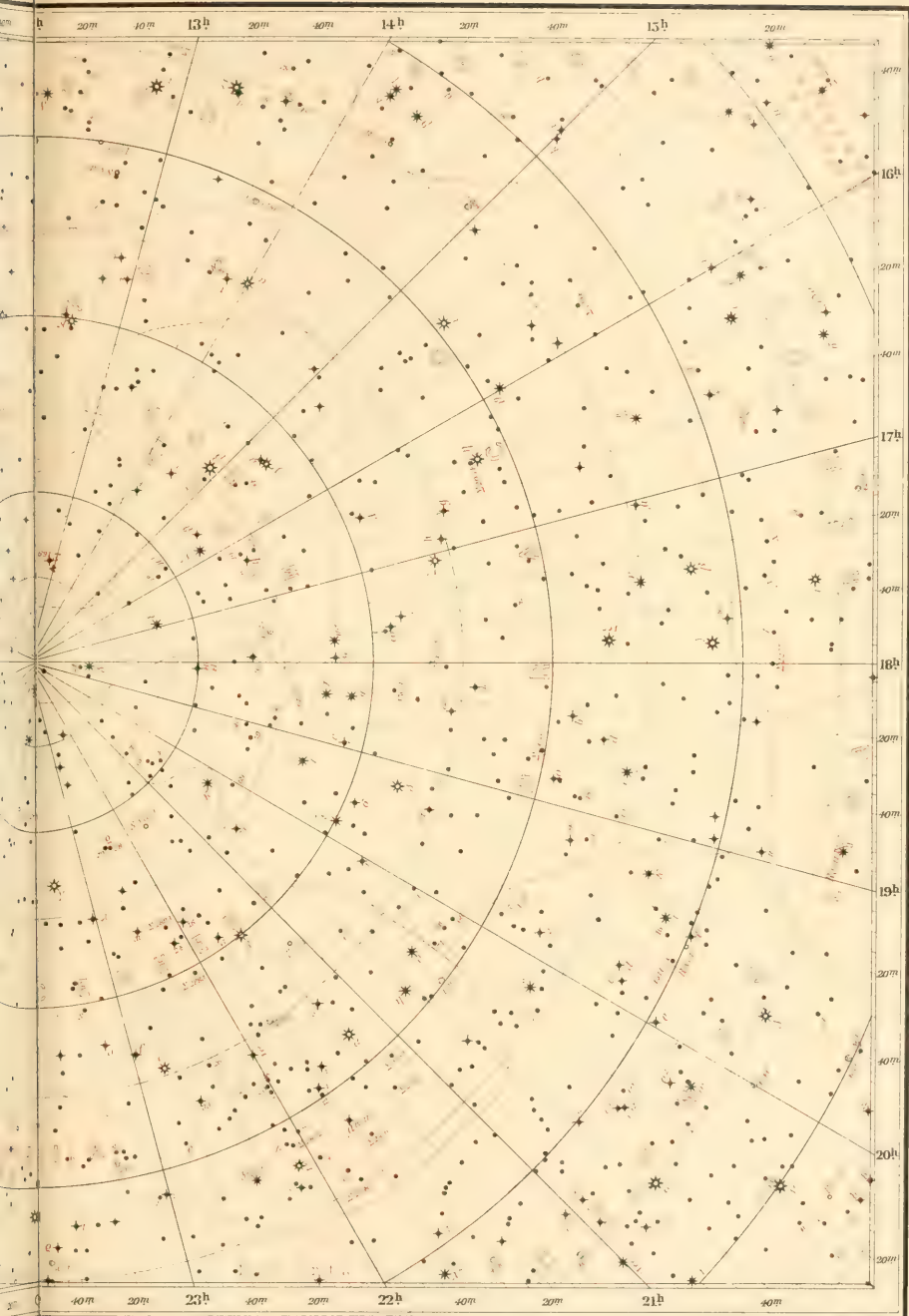


Declination = + 90°

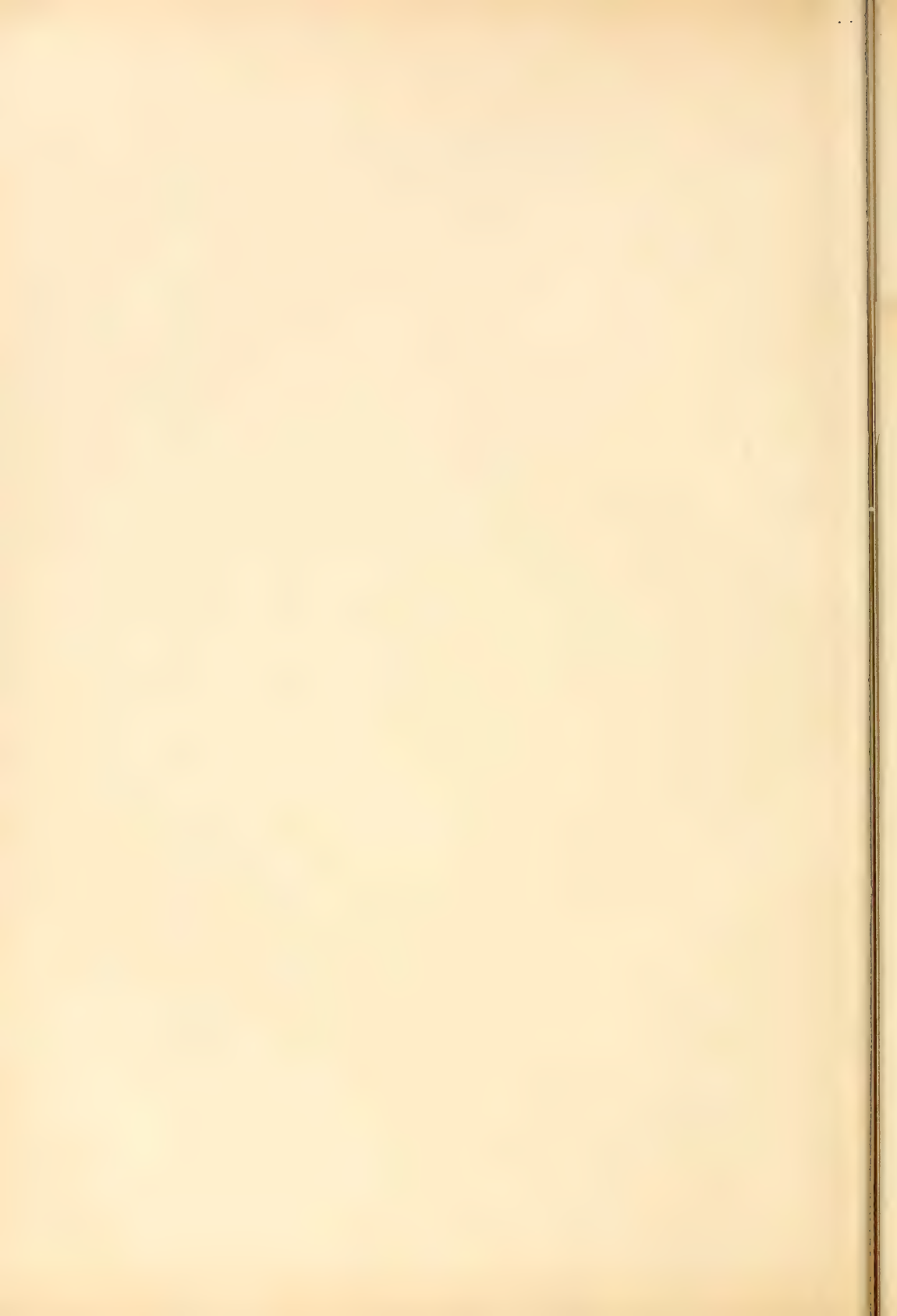


Klein, Star Atlas.

● 1<sup>m</sup>    ★ 2<sup>m</sup>    ★ 3<sup>m</sup>    ★ 4<sup>m</sup>

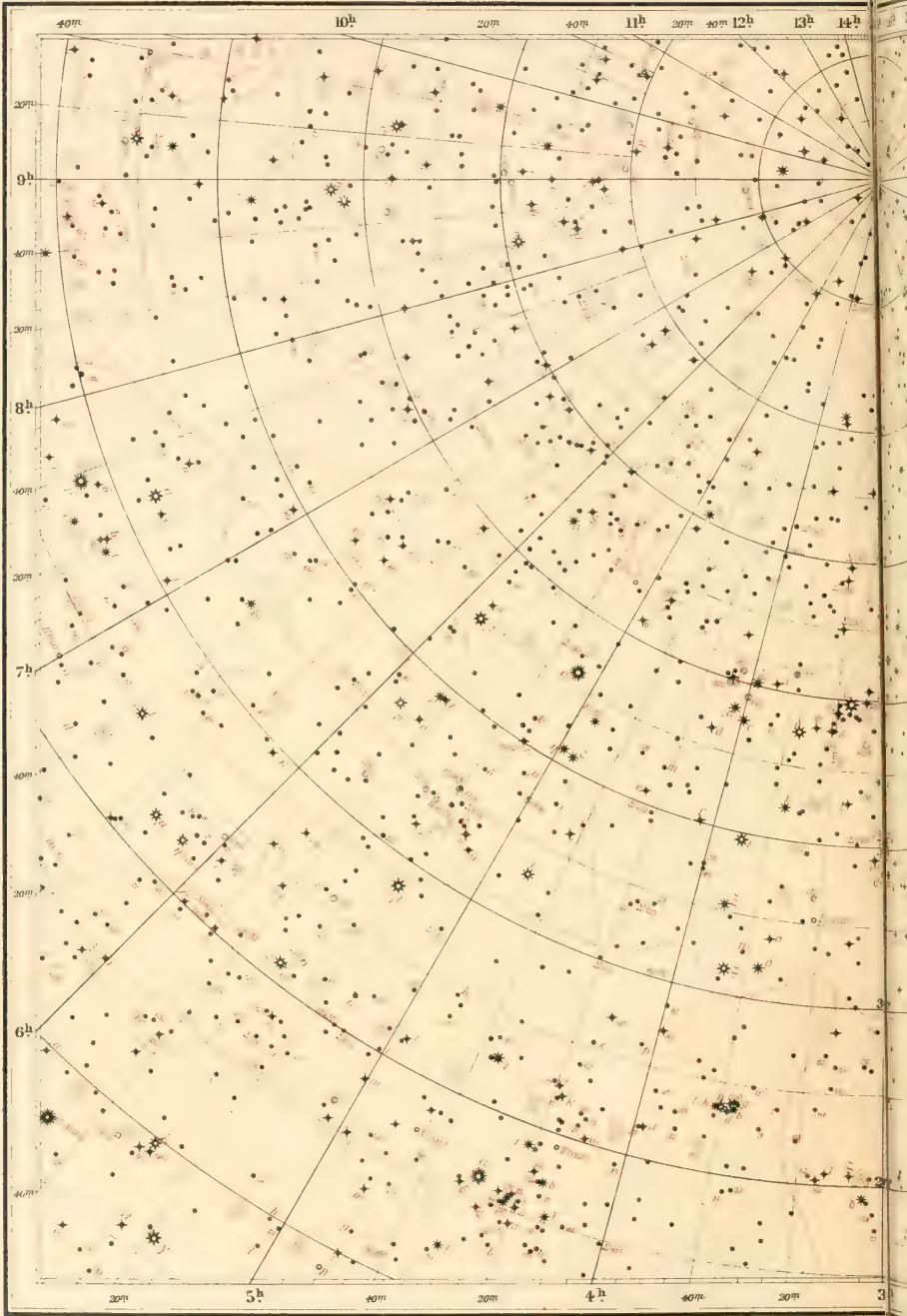


• 6<sup>m</sup> & 6.5<sup>m</sup>    ○ var. st.    nebula or cluster



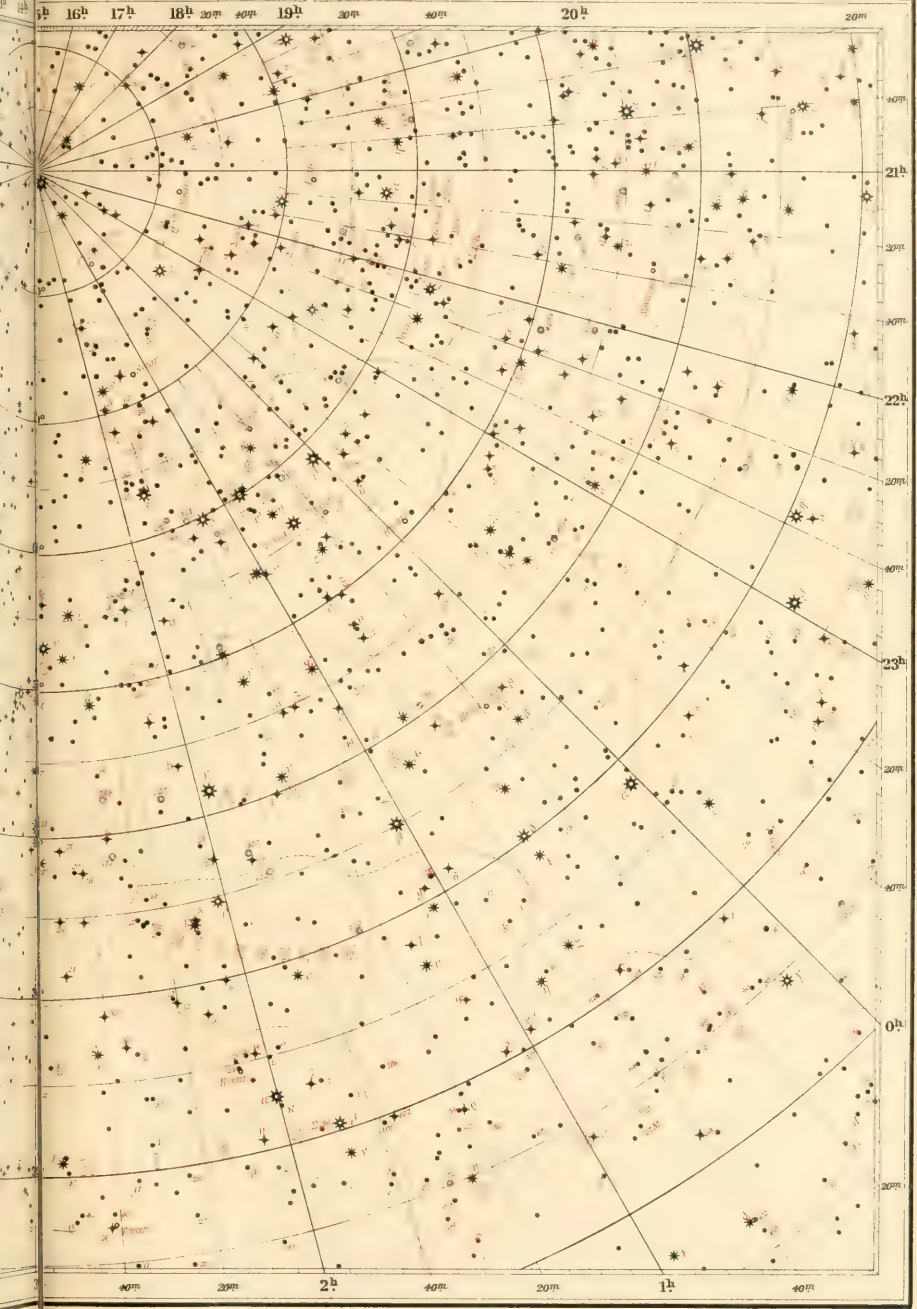


Right Ascension = 3<sup>h</sup> Declination = +58°



Klein, Star Atlas.

☉ 1<sup>m</sup>    ✨ 2<sup>m</sup>    ✨ 3<sup>m</sup>    ✨ 4<sup>m</sup>

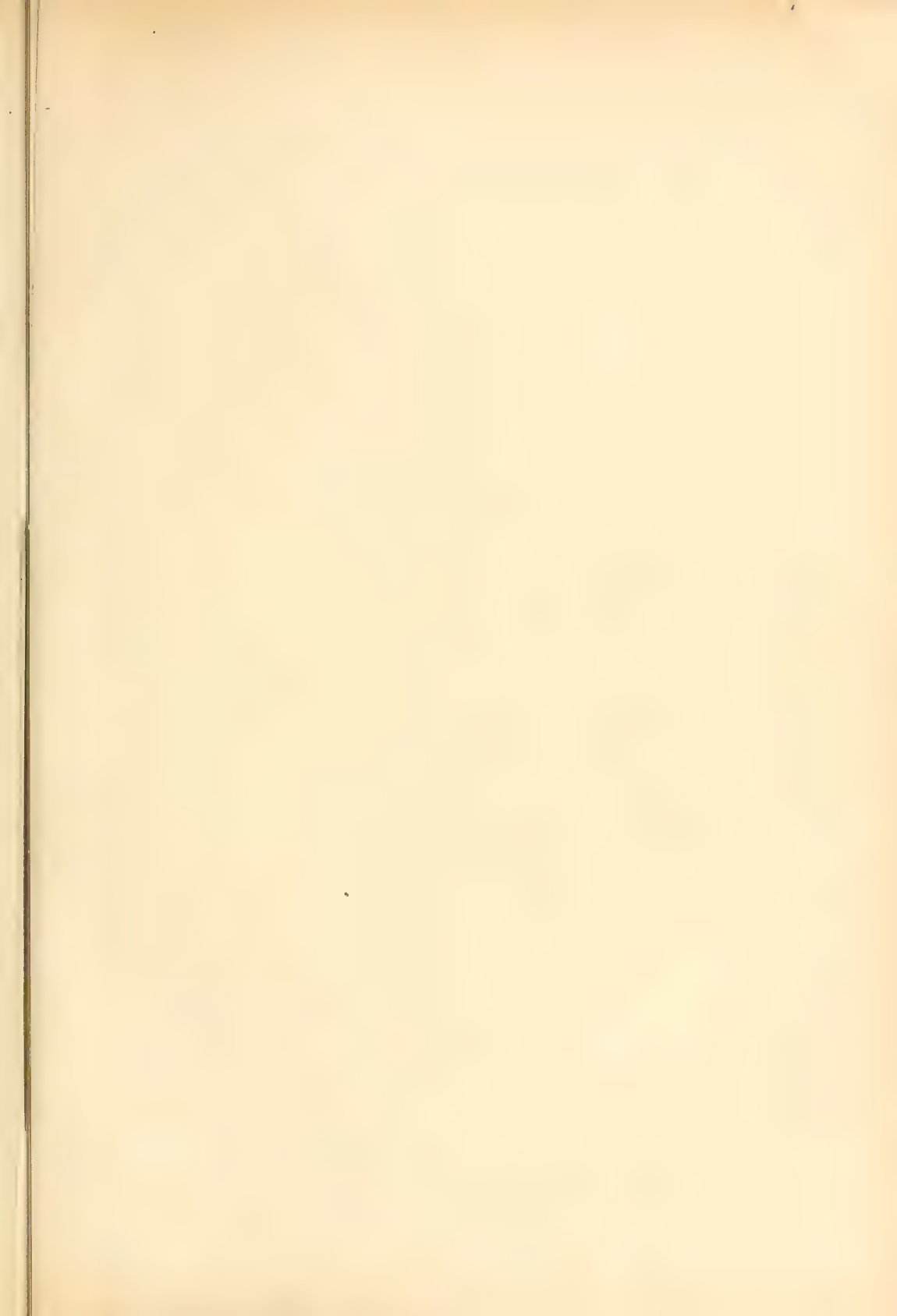


5<sup>m</sup>    • 6<sup>m</sup> & 6.5<sup>m</sup>    ○ var. st.    nebula or cluster

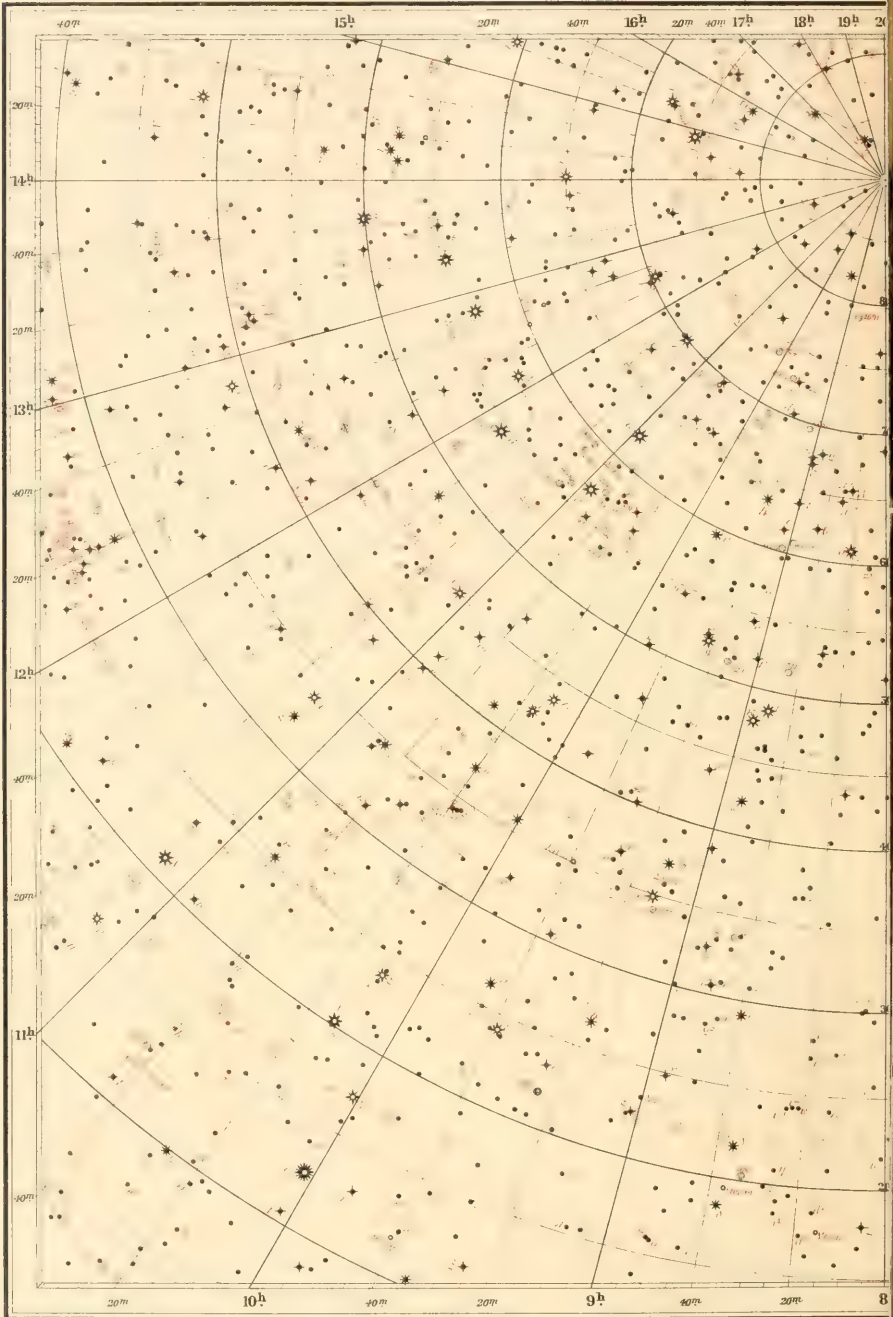
S. P. C. K. London





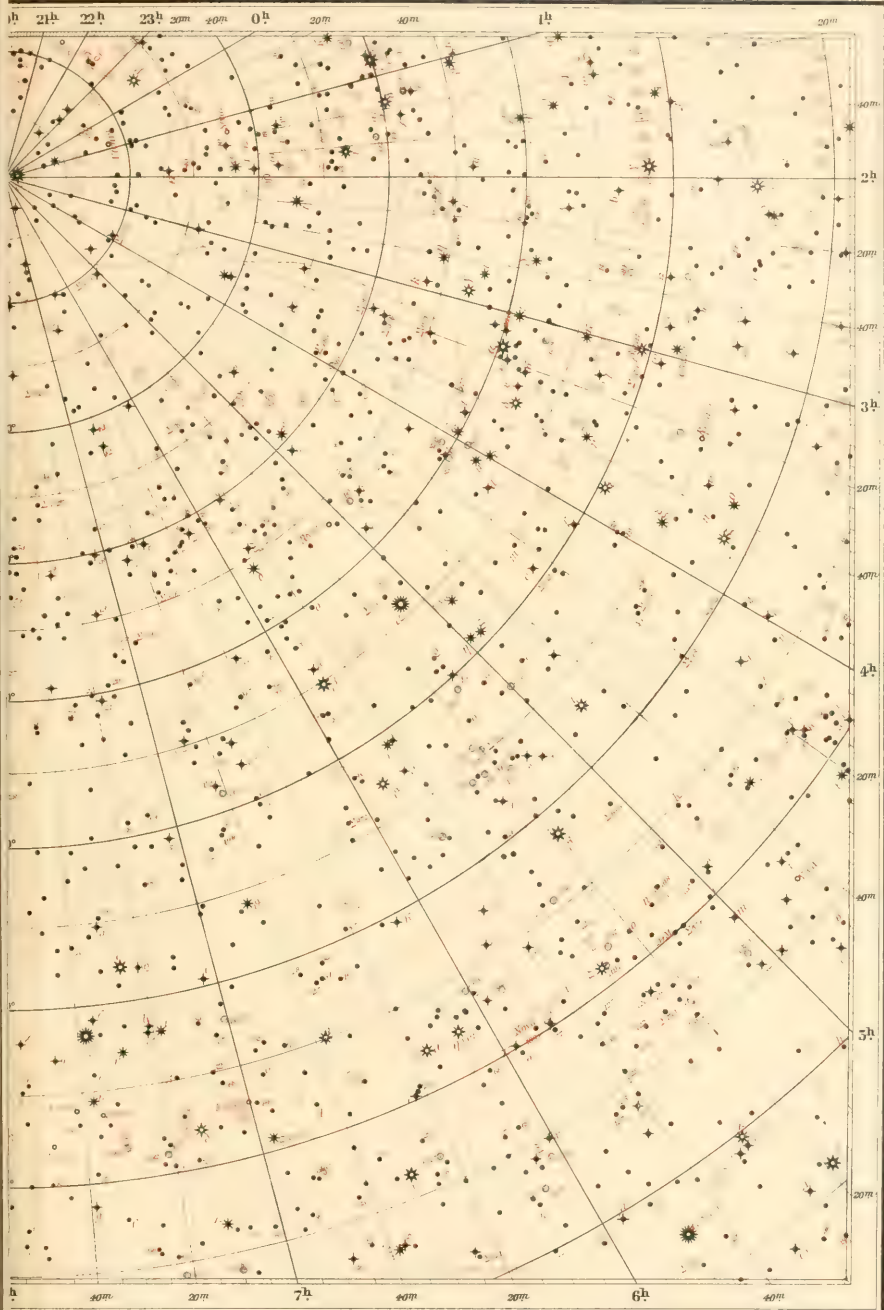


Right Ascension - 8<sup>h</sup> Declination - 58<sup>o</sup>



Klein, Star Atlas.

★ 1<sup>m</sup>    ★ 2<sup>m</sup>    ★ 3<sup>m</sup>    ★ 4<sup>m</sup>



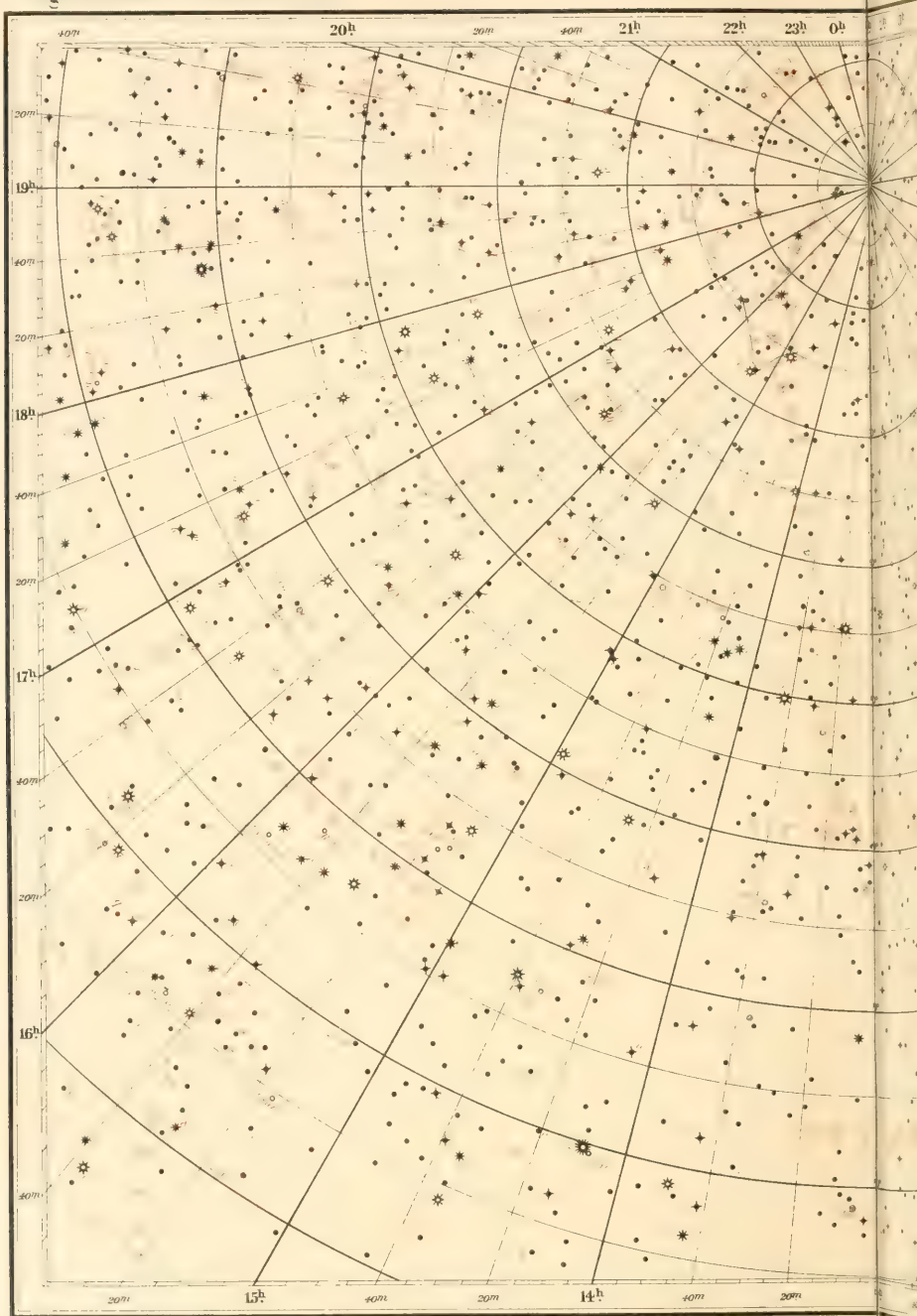
▷ 5<sup>m</sup>      • 6<sup>m</sup> & 6.5<sup>m</sup>      ◊ var. st.      ◊ nebula or cluster

S. P. C. K. London.



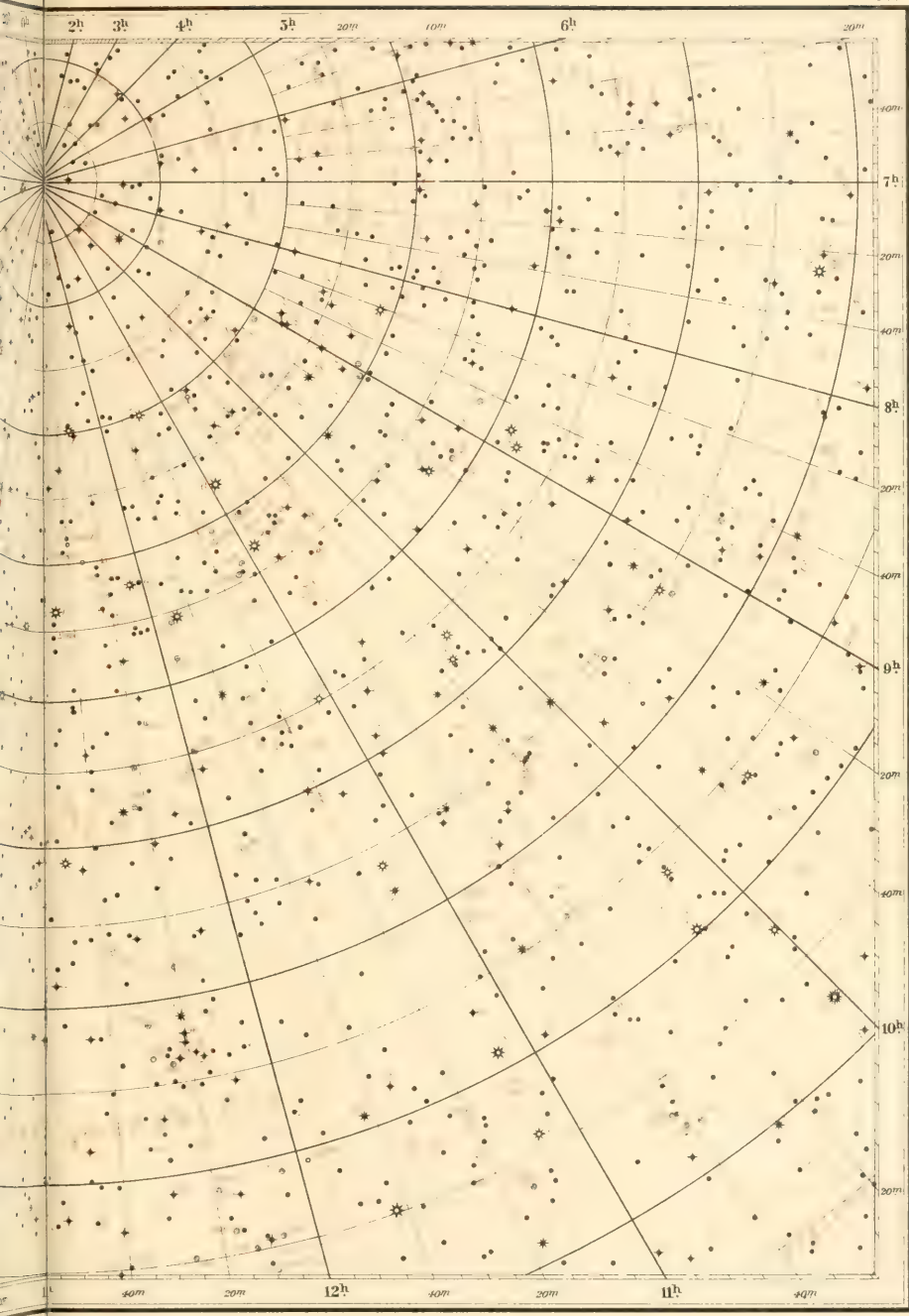


Right Ascension = 13<sup>h</sup> Declination = +58°



Klein, Star Atlas.

☀ 1<sup>m</sup>    ✨ 2<sup>m</sup>    ✨ 3<sup>m</sup>    ✨ 4<sup>m</sup>

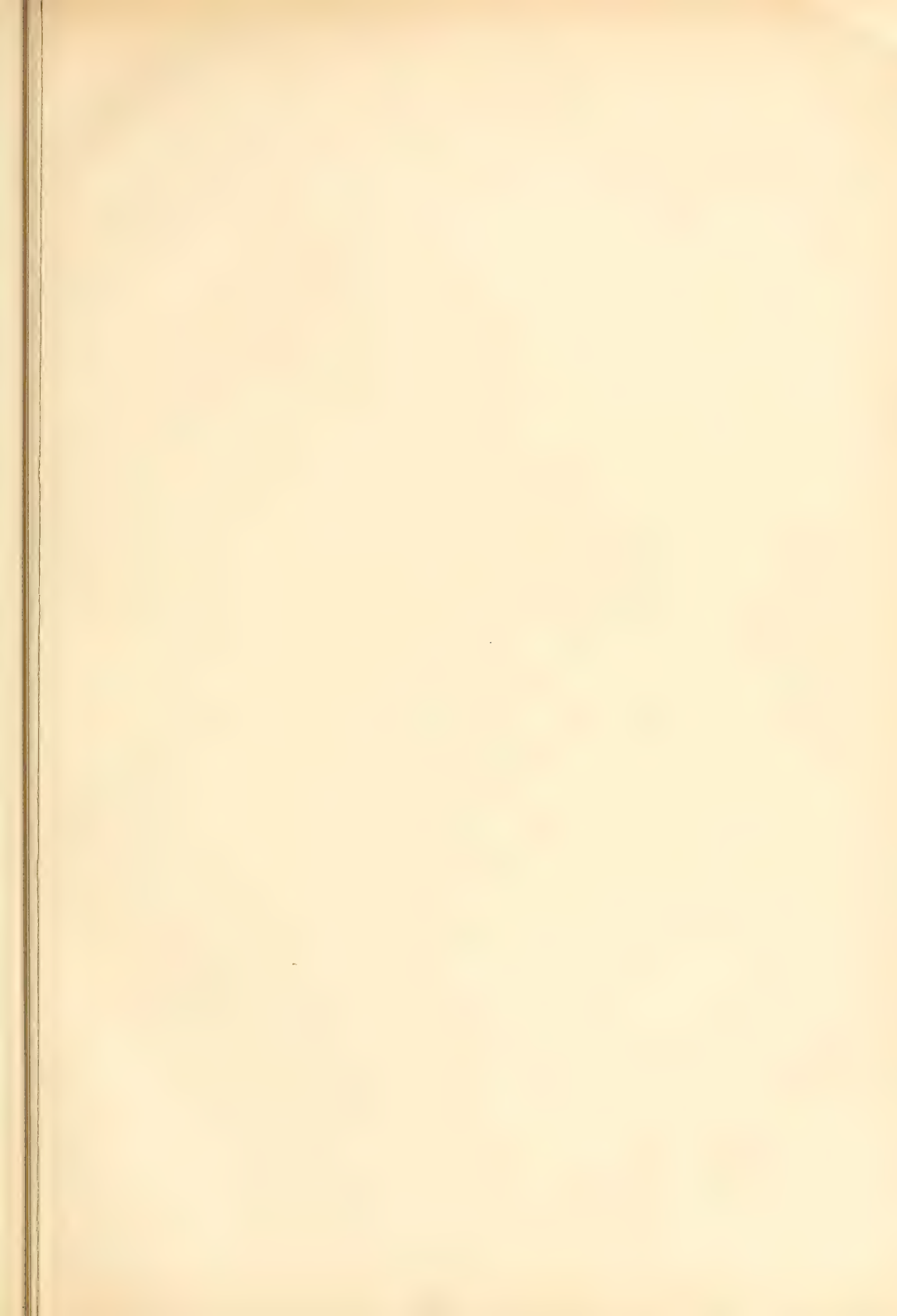


5<sup>m</sup>    • 6<sup>m</sup> & 6.5<sup>m</sup>    ◦ var. et.    ☉ nebula or cluster

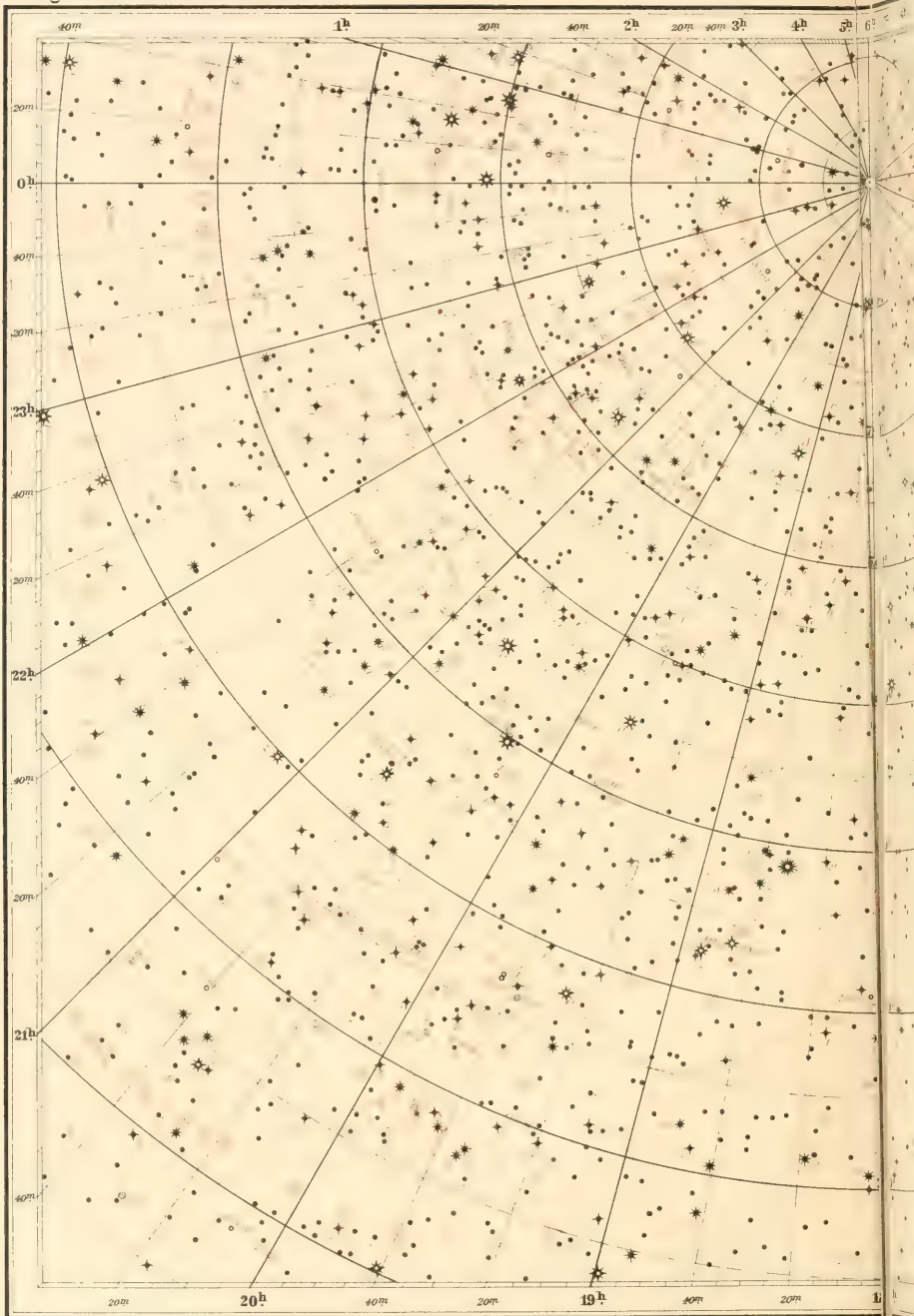
S. P. C. K. London



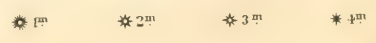




Right Ascension = 18<sup>h</sup> Declination = +53°



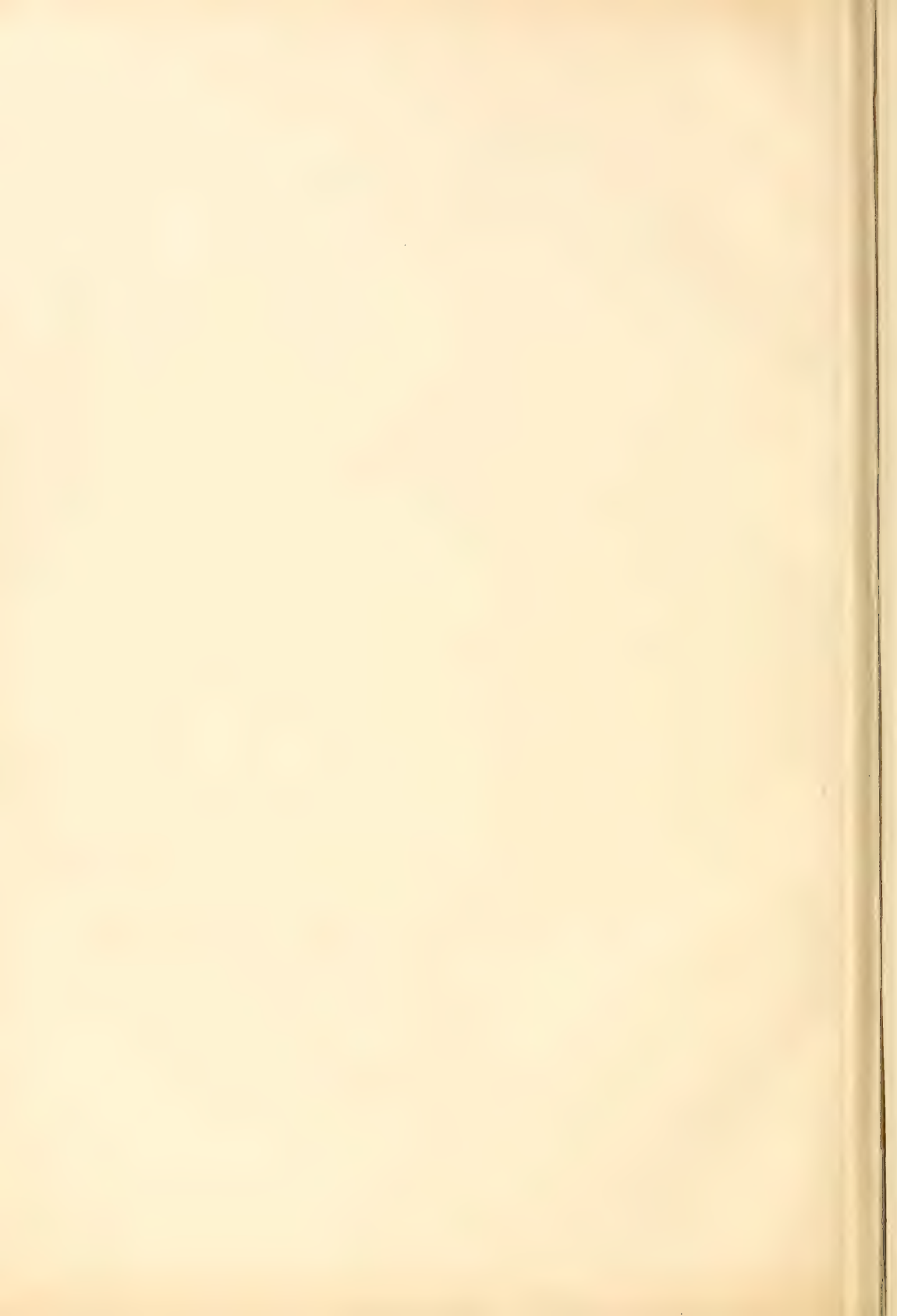
Klein, Star Atlas.

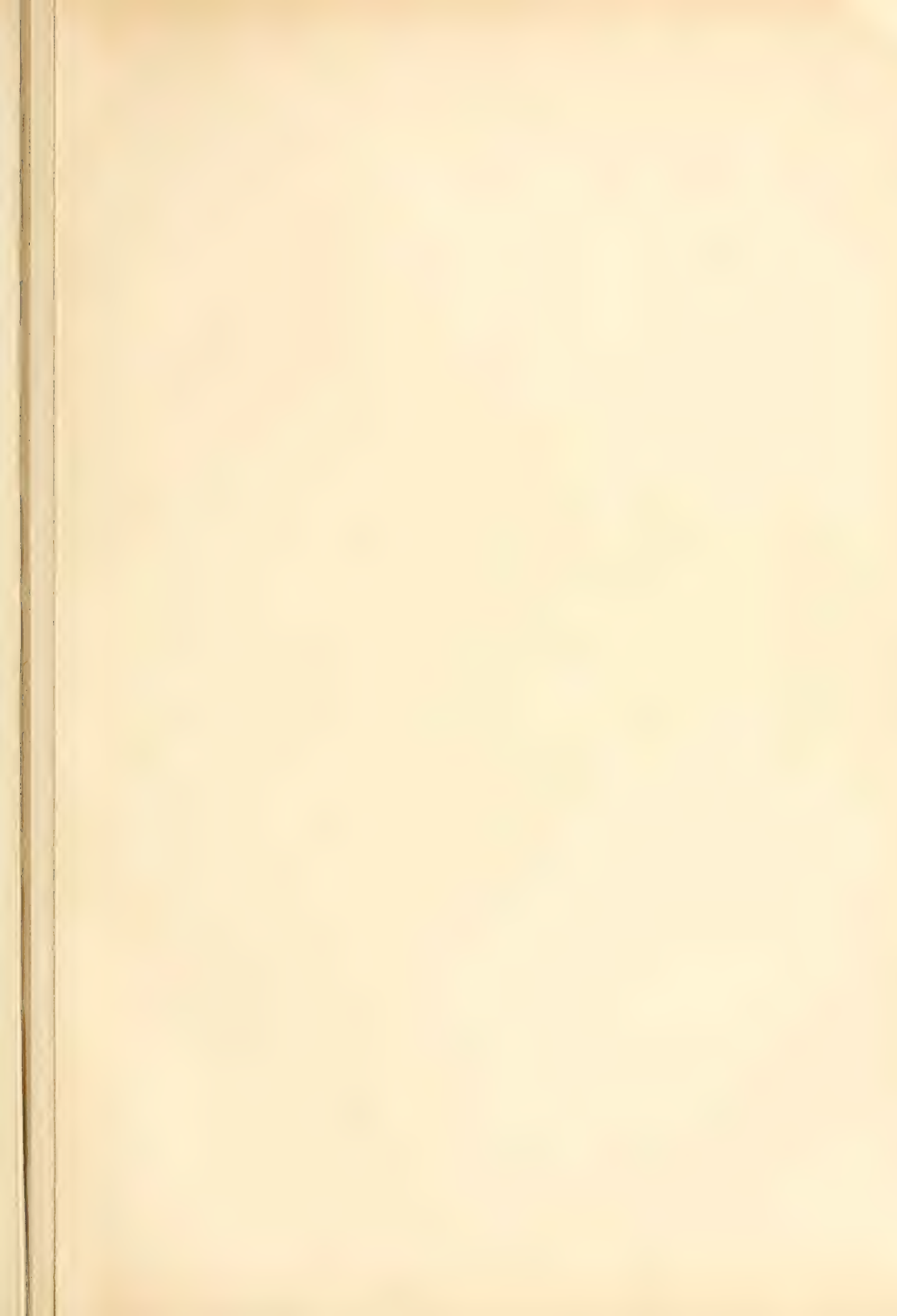




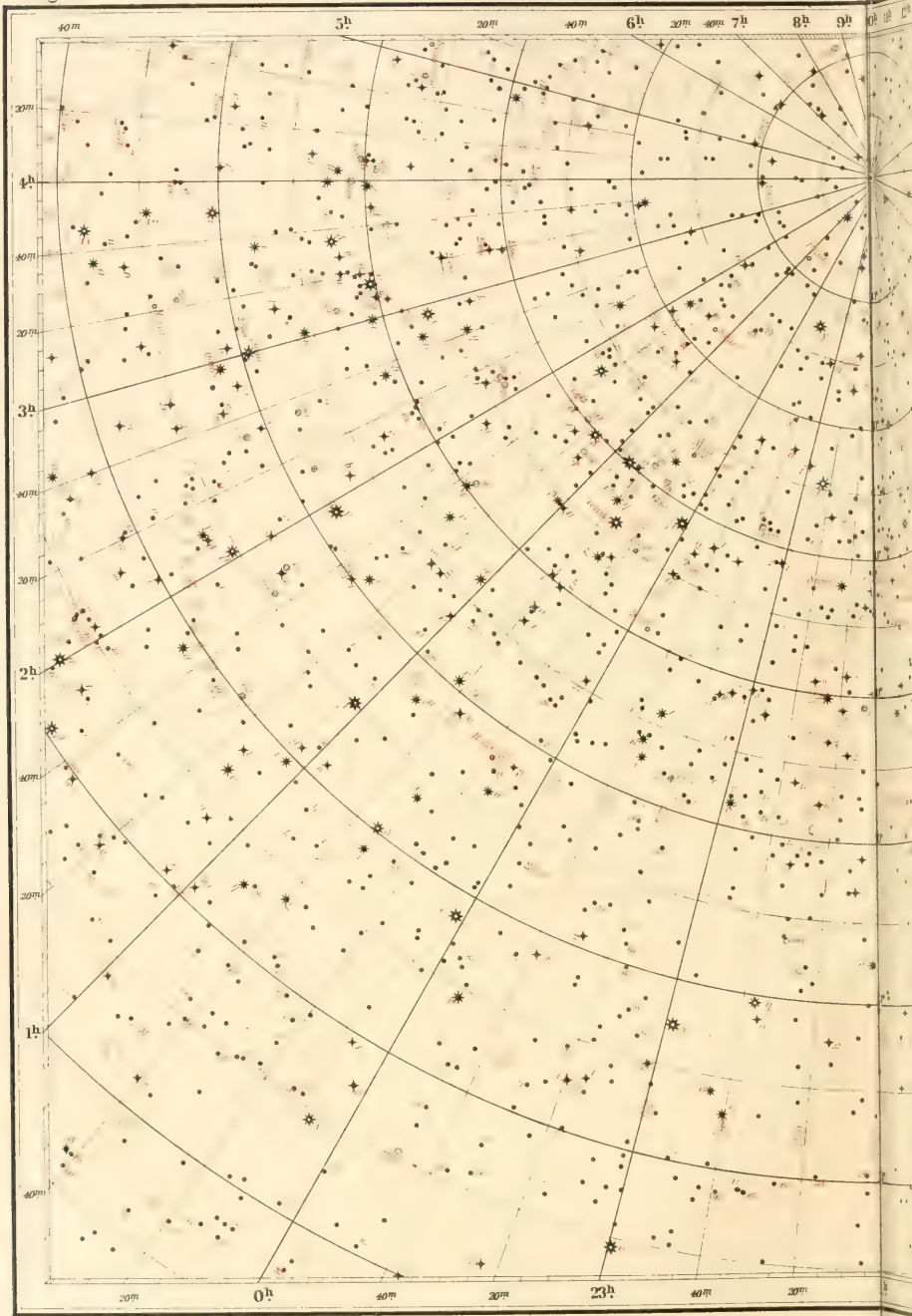
◆ 5<sup>m</sup>      ◆ 6<sup>m</sup> & 6.5<sup>m</sup>      ○ var. st.      ☉ nebula or cluster

S. P. C. K. Lowdon



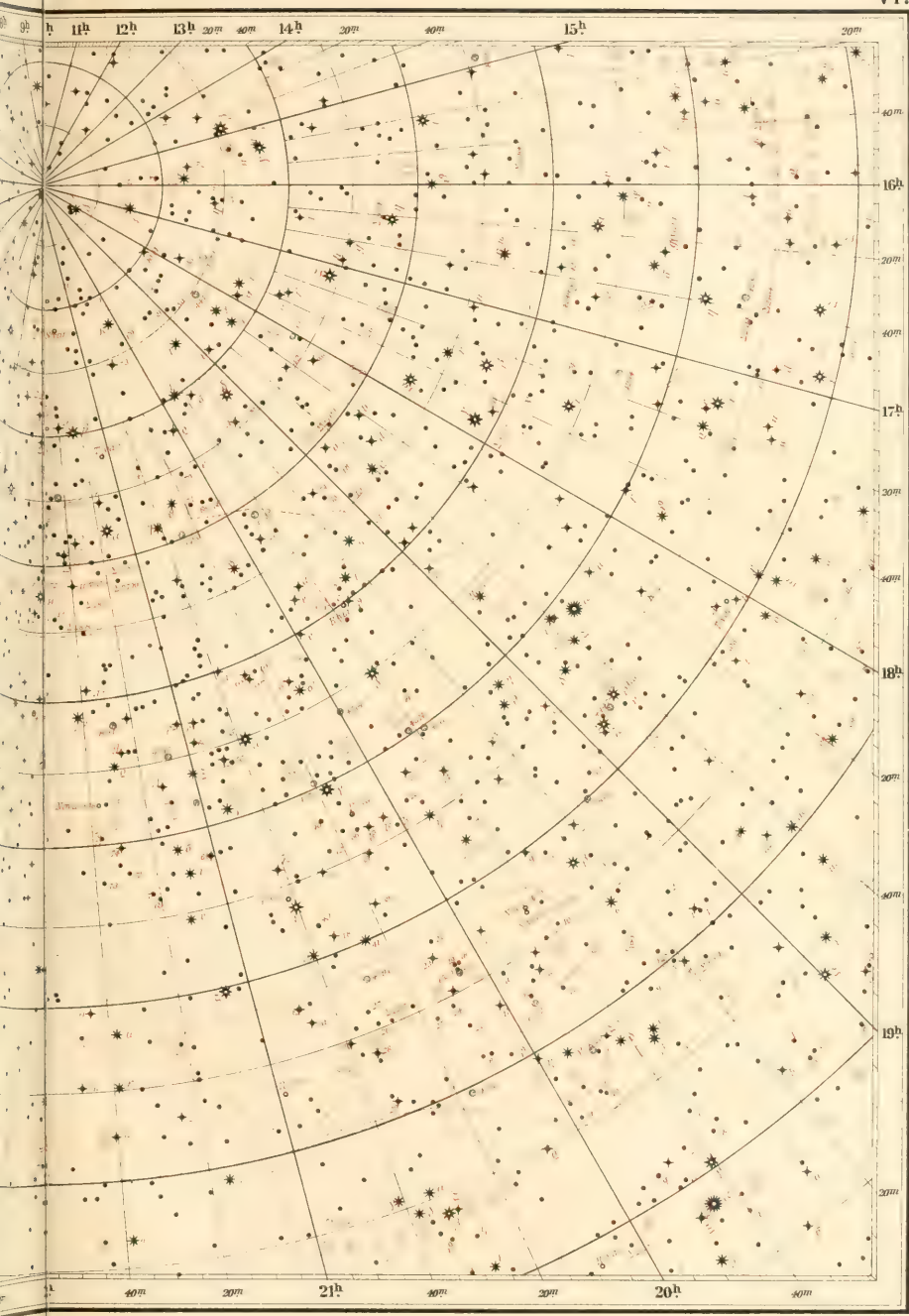


Right Ascension = 22<sup>h</sup> Declination = +58°



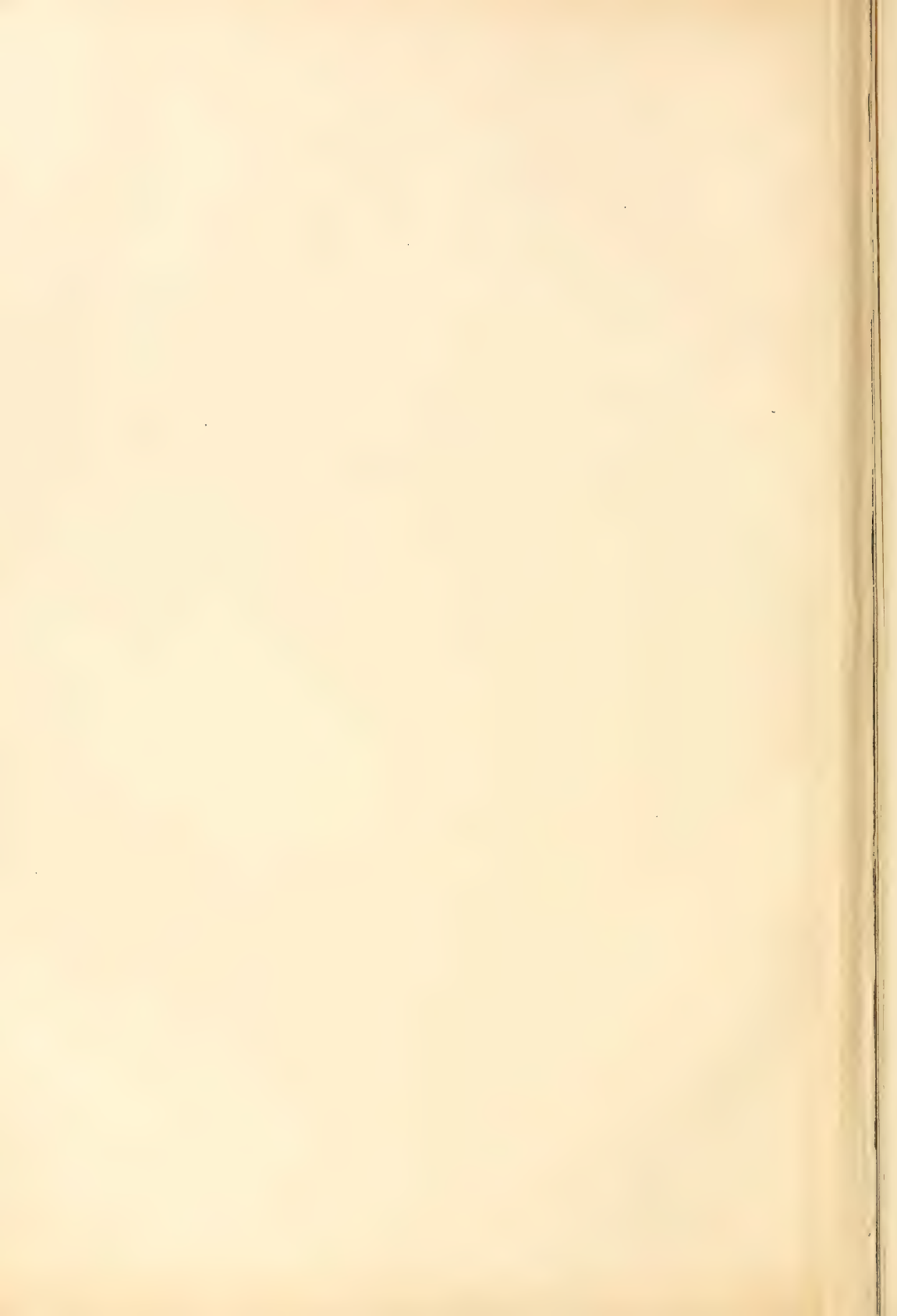
Klein, Star Atlas.

☉ 1<sup>m</sup>    ✧ 2<sup>m</sup>    ✨ 3<sup>m</sup>    ✨ 4<sup>m</sup>



5<sup>m</sup>      • 6<sup>m</sup> & 6.5<sup>m</sup>      ○ var. st.      nebula or cluster

S. P. C. K. London.



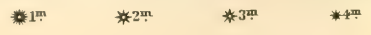




Right Ascension - 22<sup>h</sup> Declination - -3°



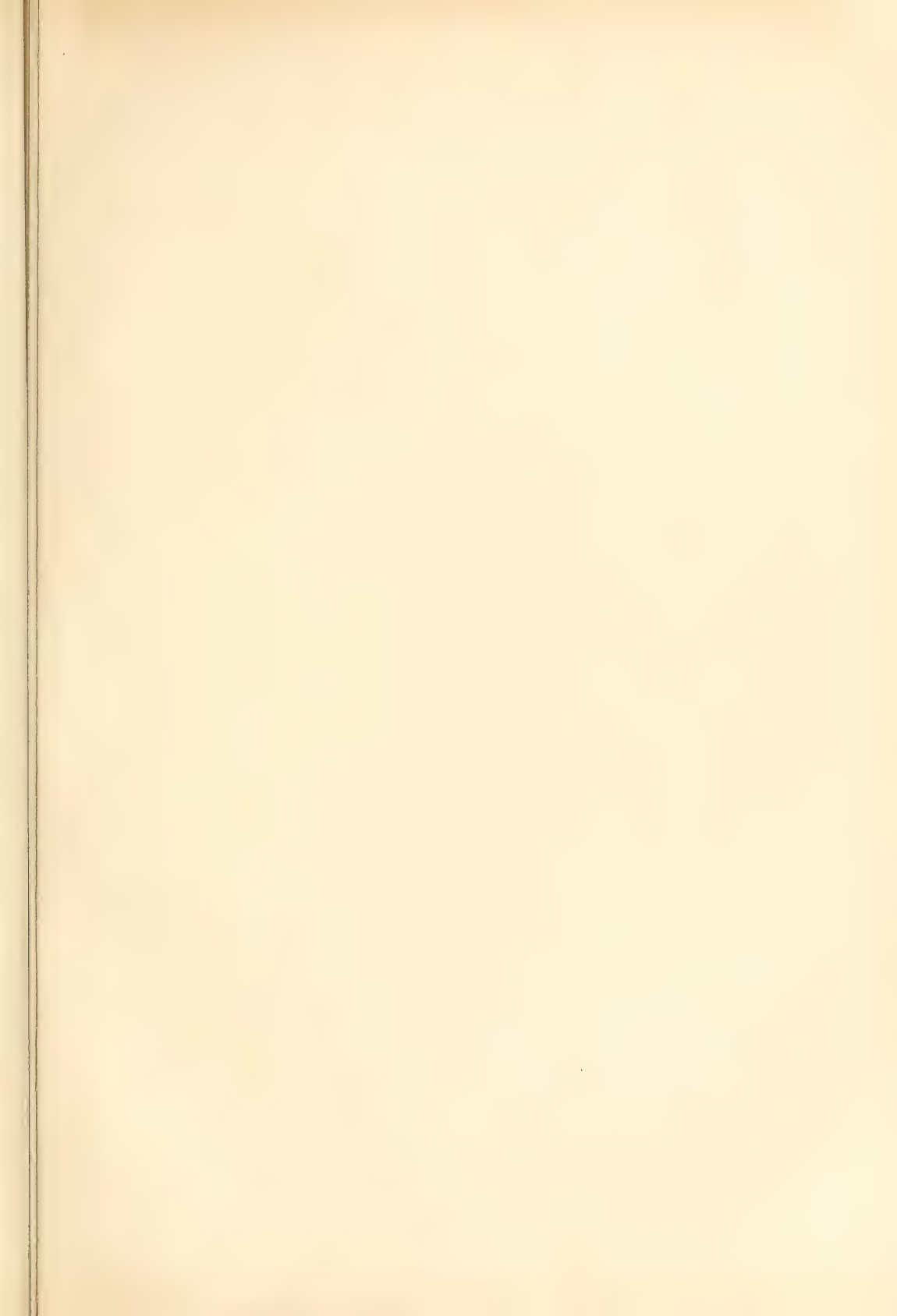
Klein, Star Atlas.



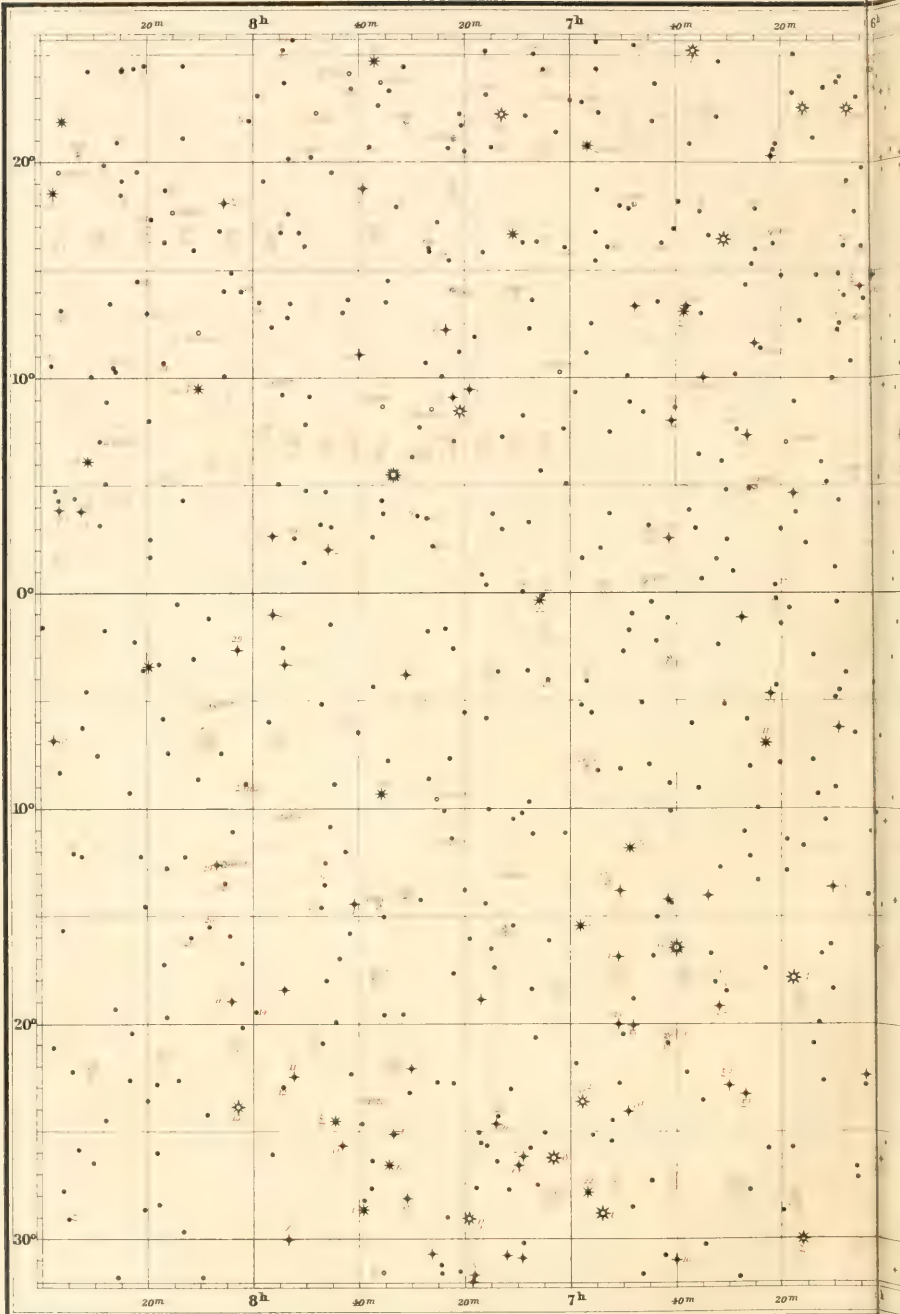


● 6<sup>m</sup> & 6.5<sup>m</sup> ○ var. st. ☆ nebula or cluster





Right Ascension =  $6^h$  Declination =  $-3^\circ$



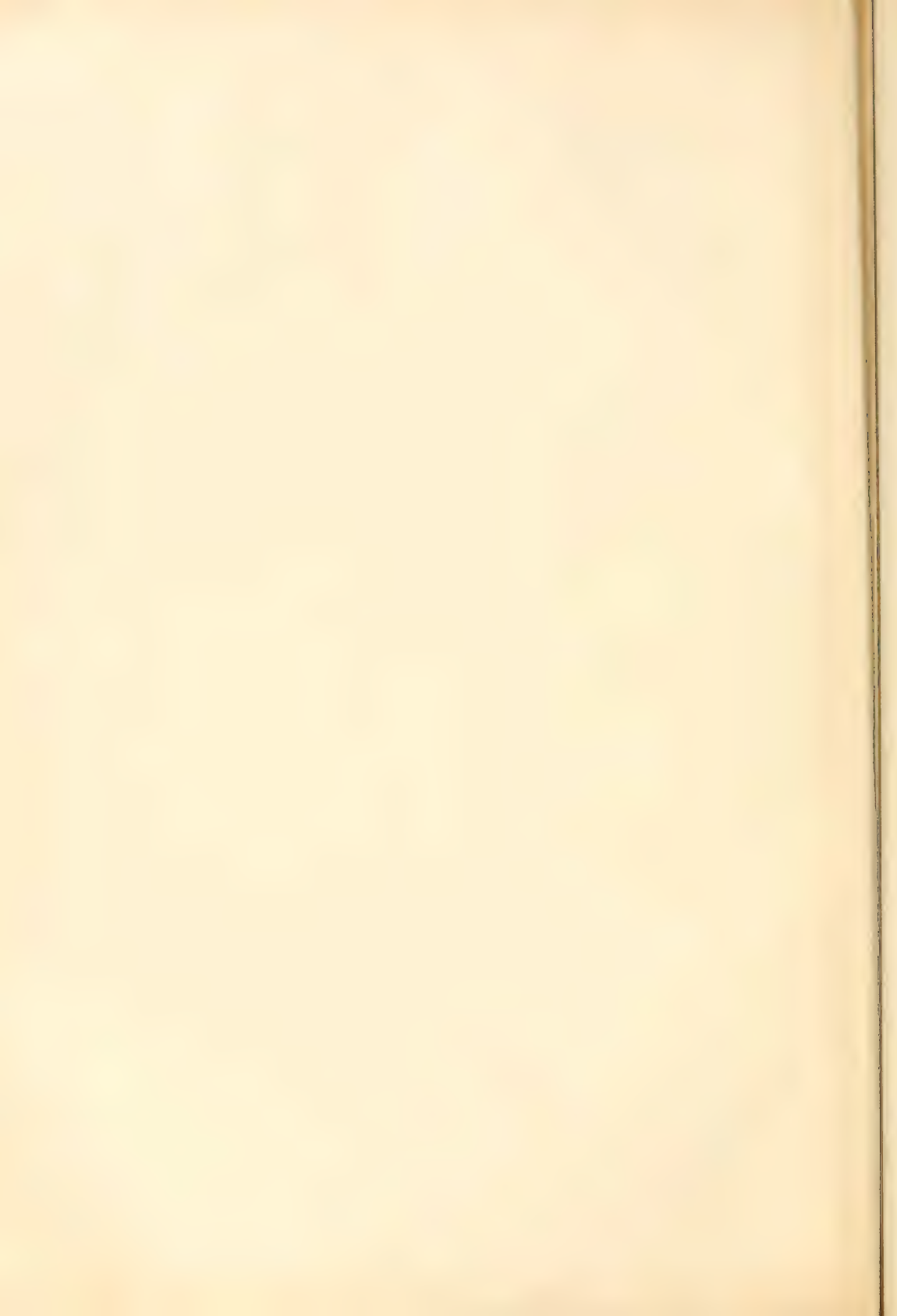
Klein. Star Atlas.

★ 1<sup>m</sup>    ★ 2<sup>m</sup>    ★ 3<sup>m</sup>    ★ 4<sup>m</sup>

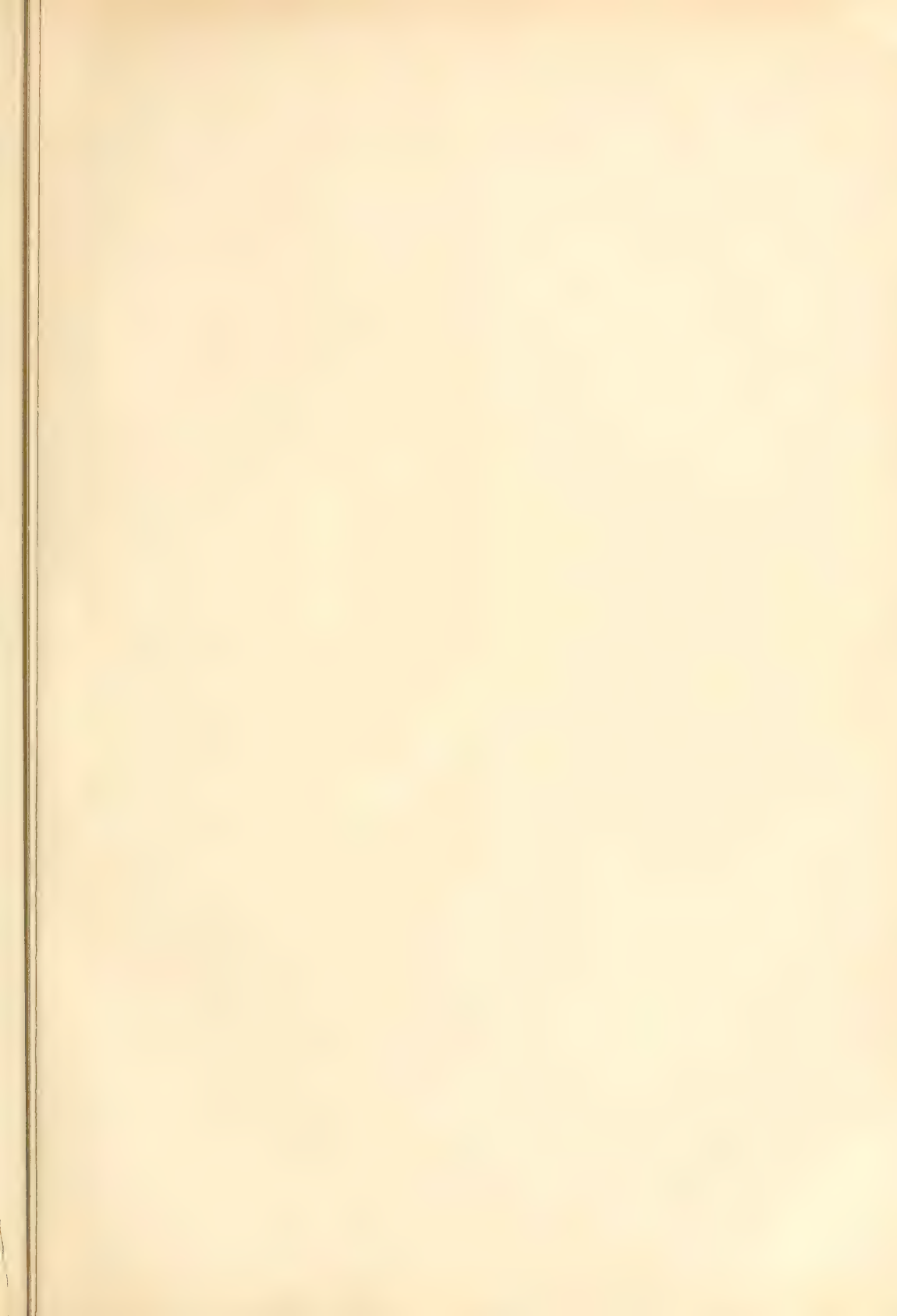


5<sup>m</sup> • 6<sup>m</sup> & 6.5<sup>m</sup> o var. st. nebula or cluster

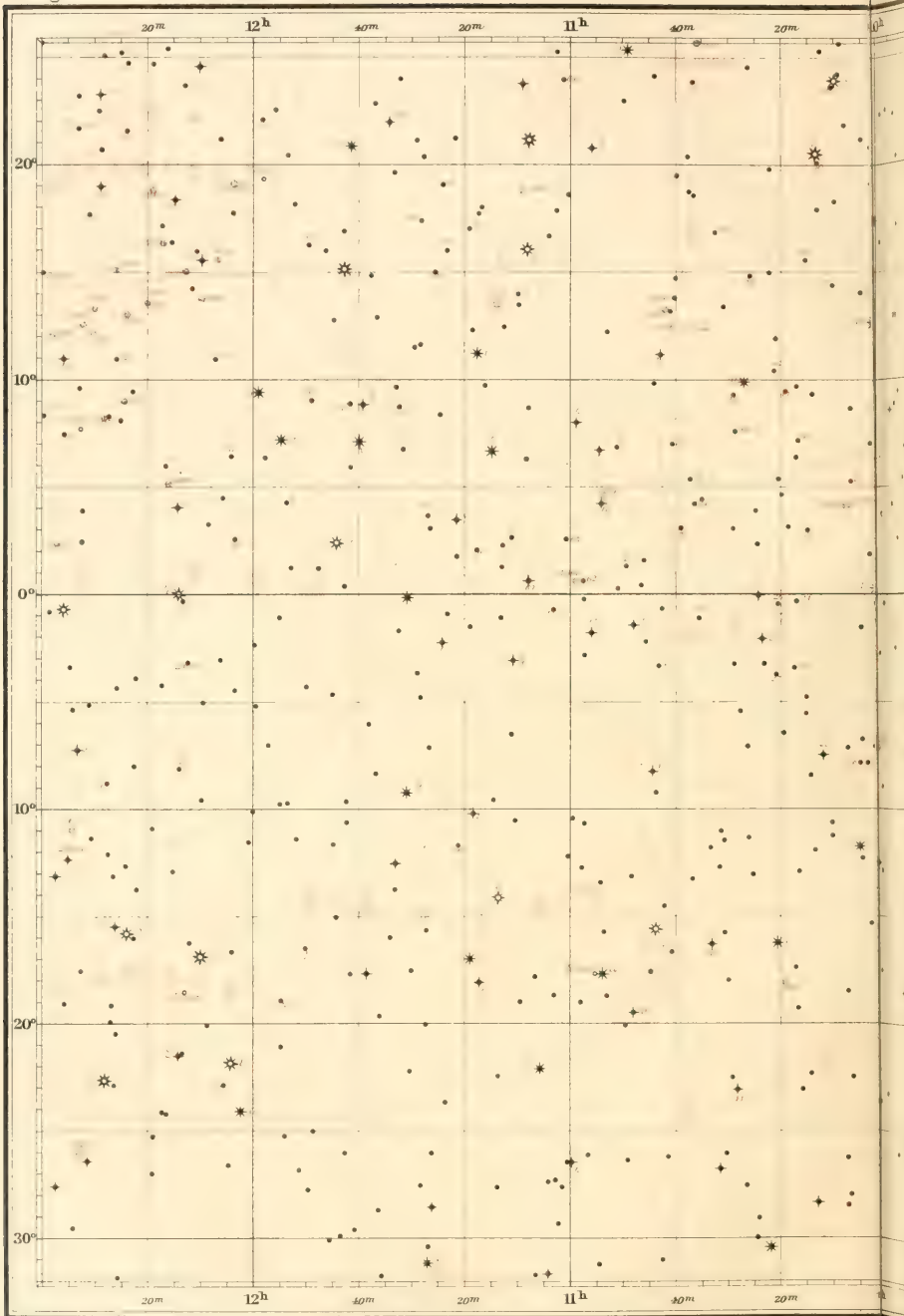
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Right Ascension - 10<sup>h</sup> Declination - -3°

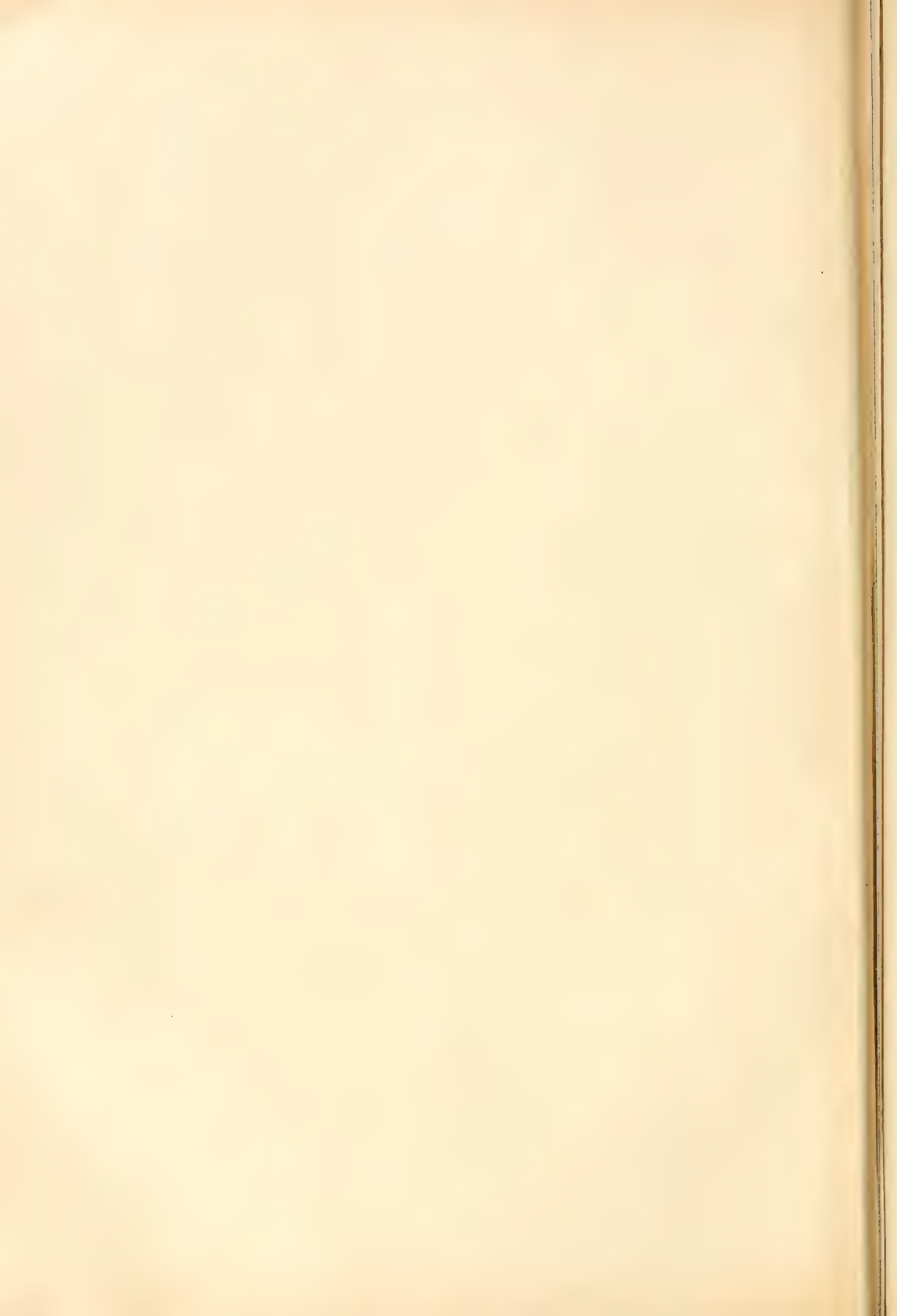


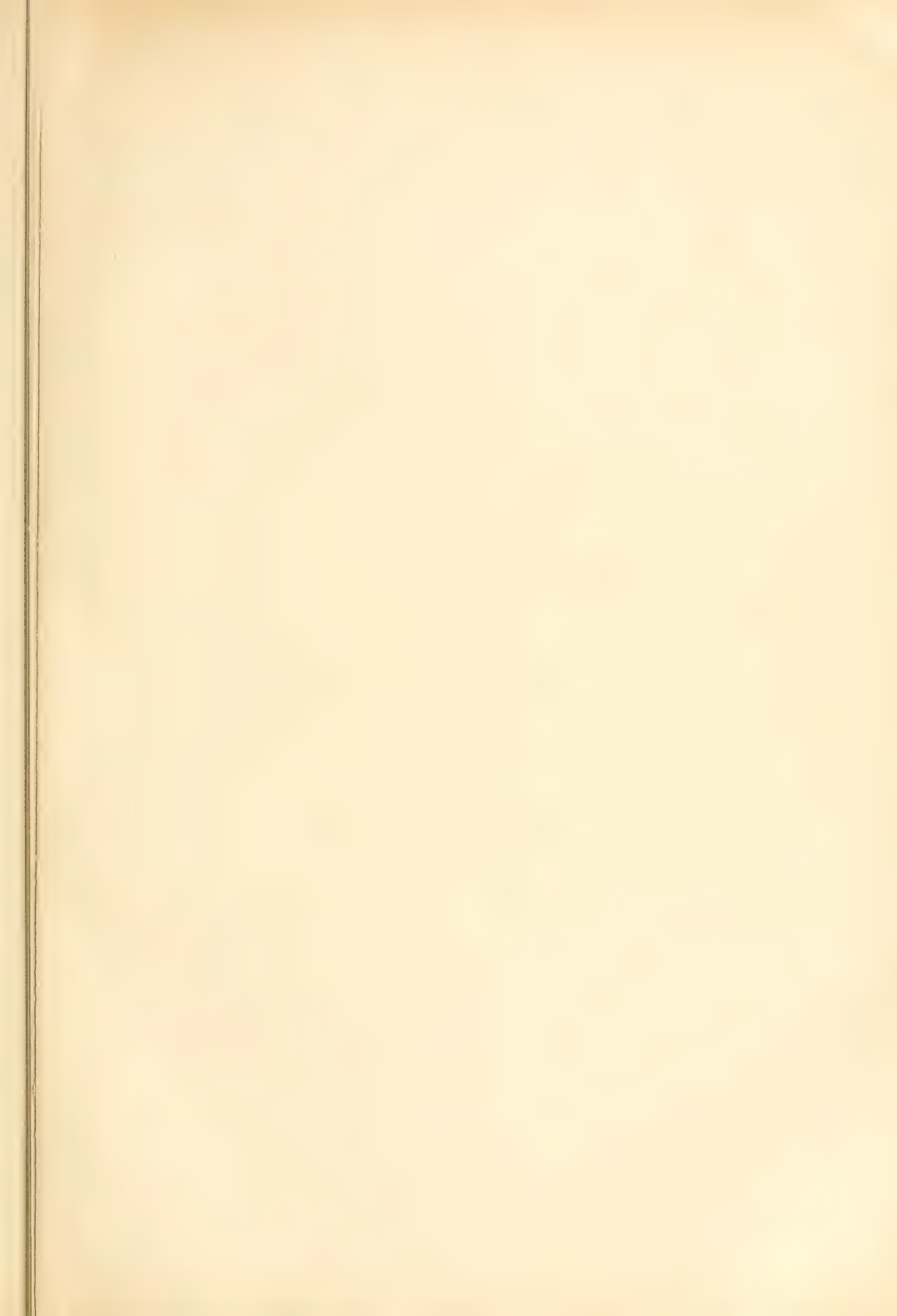
Klein, Star Atlas.

☼ 1<sup>m</sup>    ✱ 2<sup>m</sup>    ✱ 3<sup>m</sup>    ✱ 4<sup>m</sup>



5<sup>m</sup>      ● 6<sup>m</sup> & 6.5<sup>m</sup>      ○ var. st.      — nebula or cluster





Right Ascension =  $14^{\text{h}}$  Declination =  $-3^{\circ}$



Klein, Star Atlas.

☉ 1<sup>m</sup>    ✨ 2<sup>m</sup>    ✨ 3<sup>m</sup>    ✨ 4<sup>m</sup>



• 6<sup>m</sup> & 6.5<sup>m</sup>    o var. st.    nebula or cluster







Right Ascension - 17<sup>h</sup> Declination - 3°



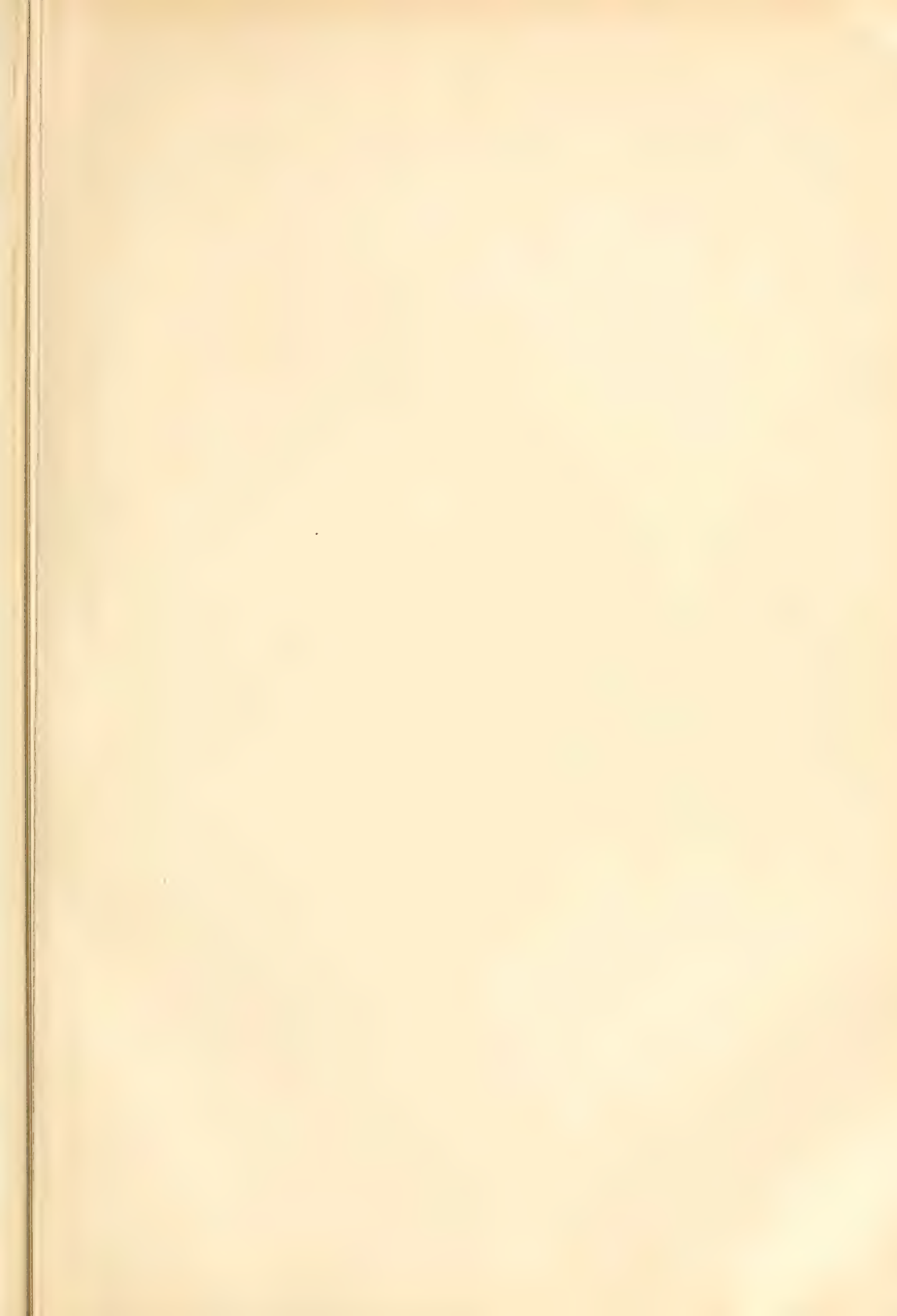
Klein, Star Atlas.

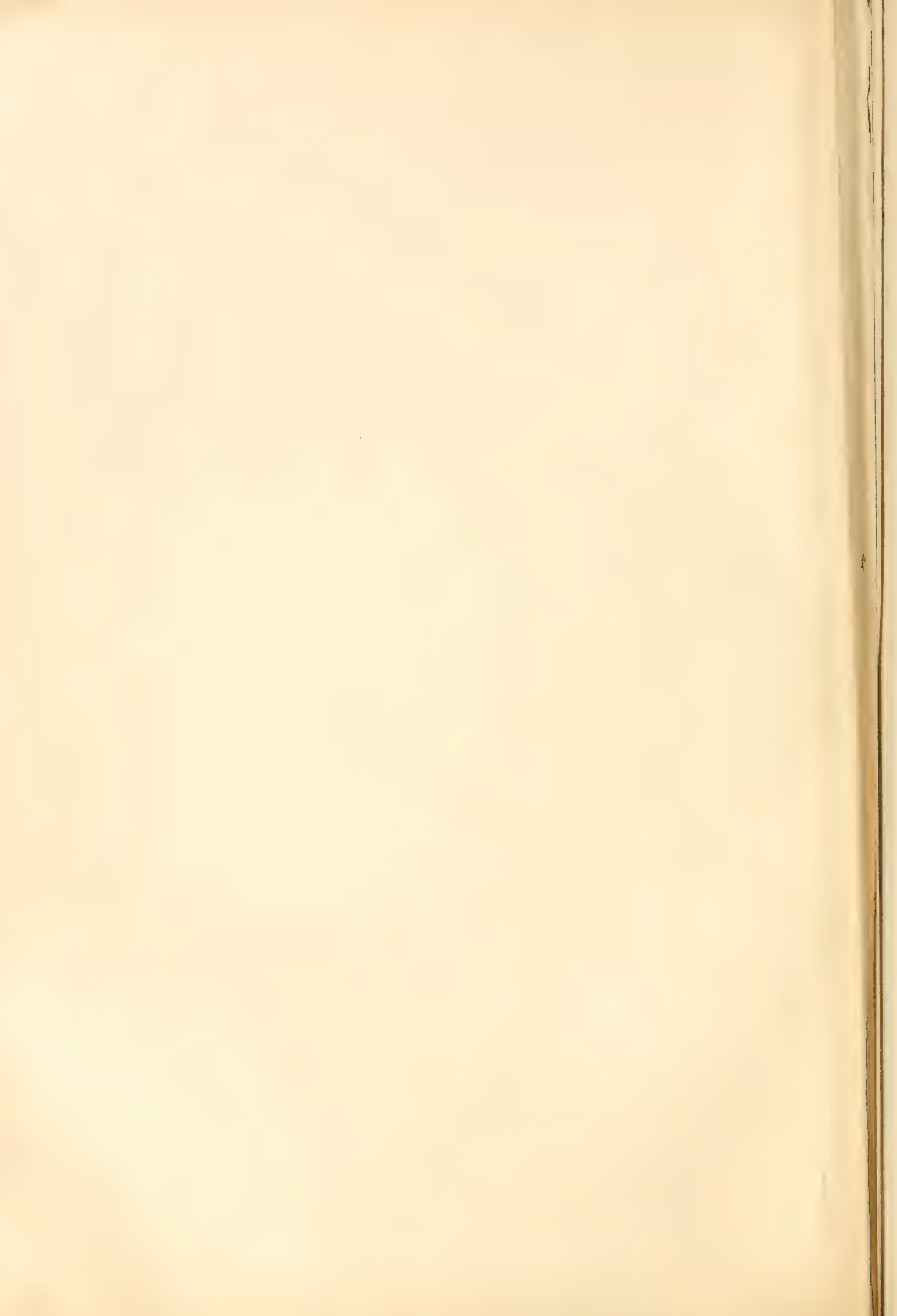
★ 1<sup>m</sup>    ★ 2<sup>m</sup>    ★ 3<sup>m</sup>    ★ 4<sup>m</sup>



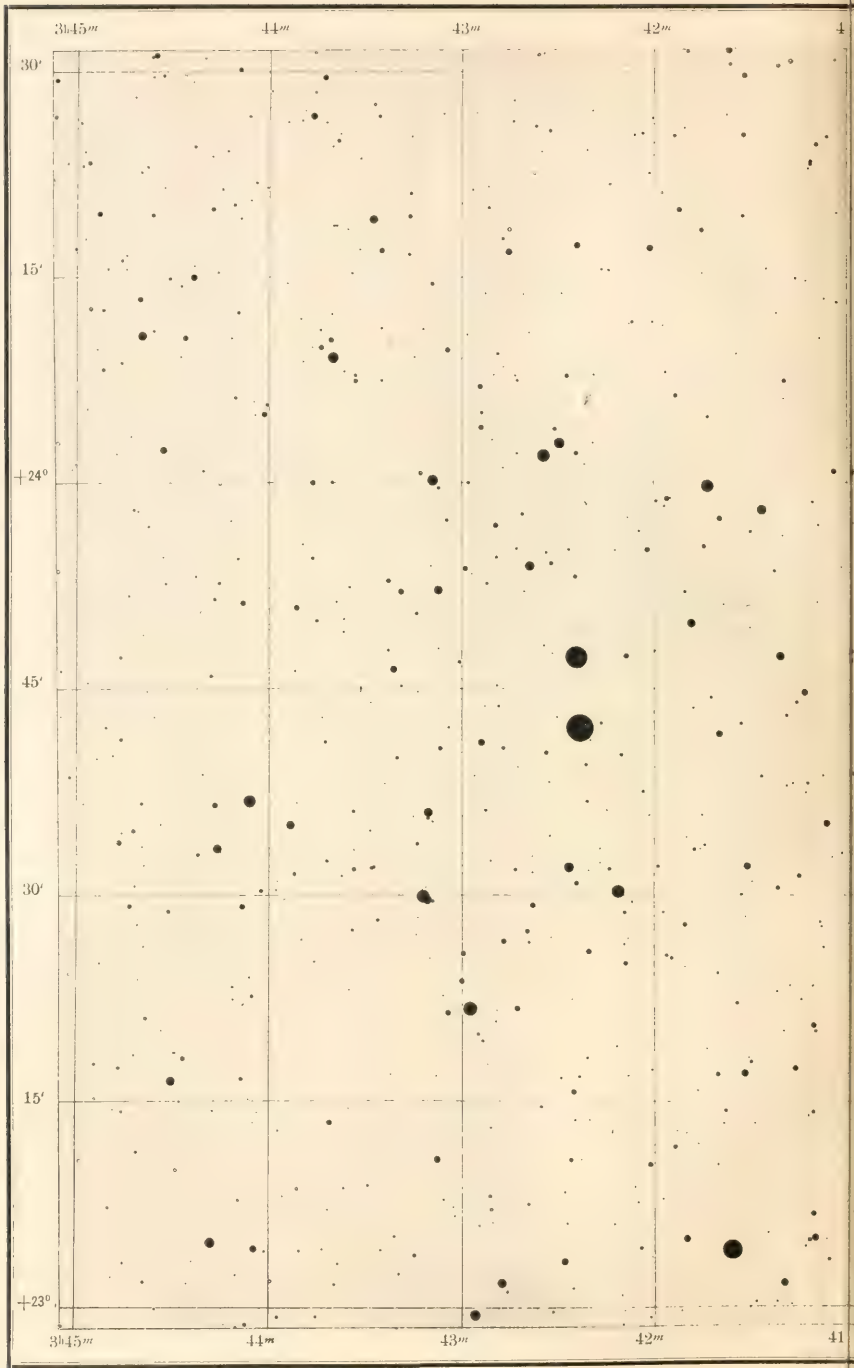
• 6<sup>m</sup> & 6.5<sup>m</sup>    ○ var. st.    ☉ nebula or cluster











KLEIN, Star-Atlas,



The Star Cluster of the  
 Reproduction of a photograph taken





10 11 12 13 14 15 16

S. P. C. K. London.

Cluster of the Pleiades.  
Made by the Brothers HENRY, Paris.

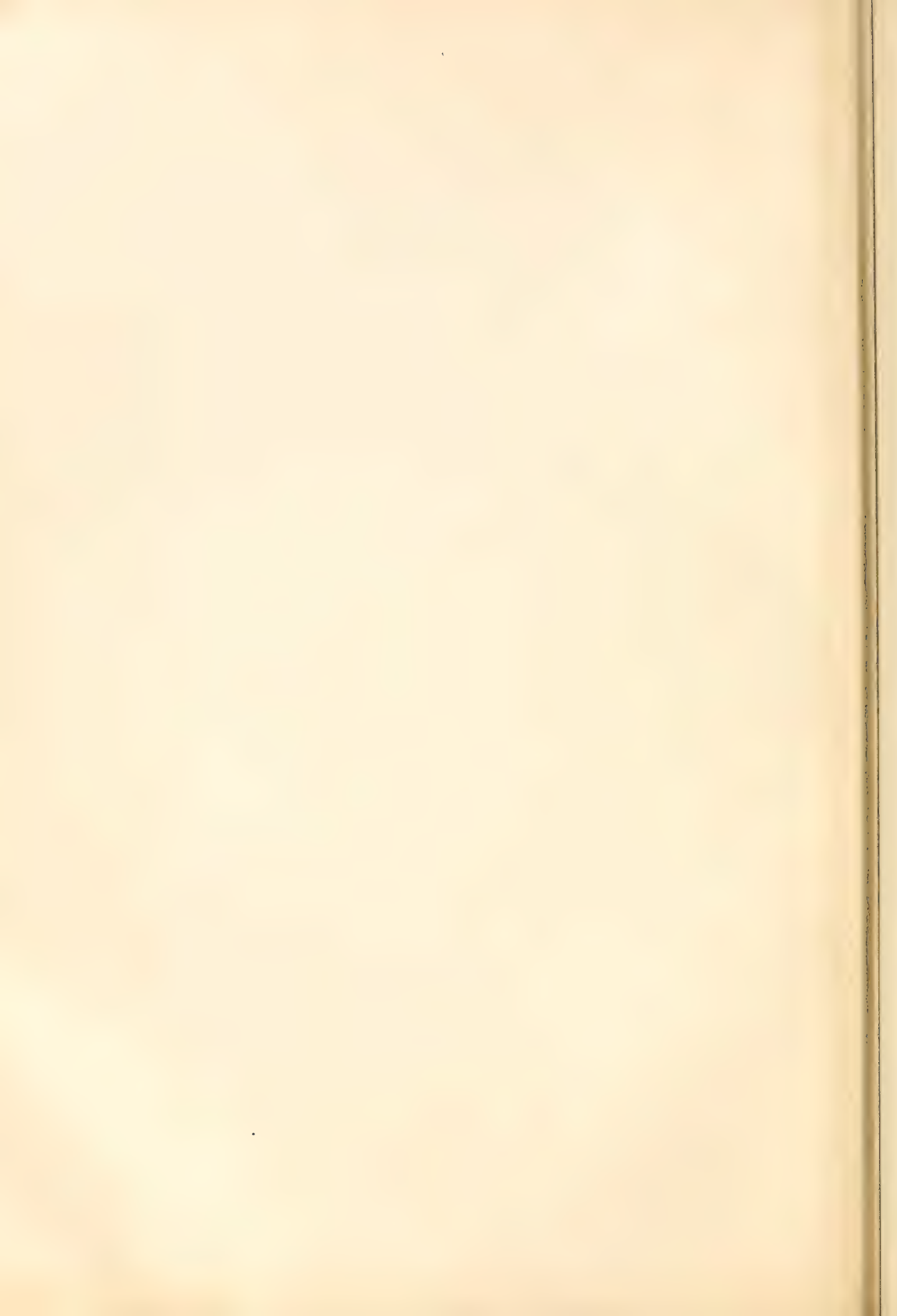






Photo. S. I. Atank

The Great Nebula in Cassiopeia  
after C. P. R.



S. P. C. K. London.







Nebula G. C. 4355 after Trouvelot.





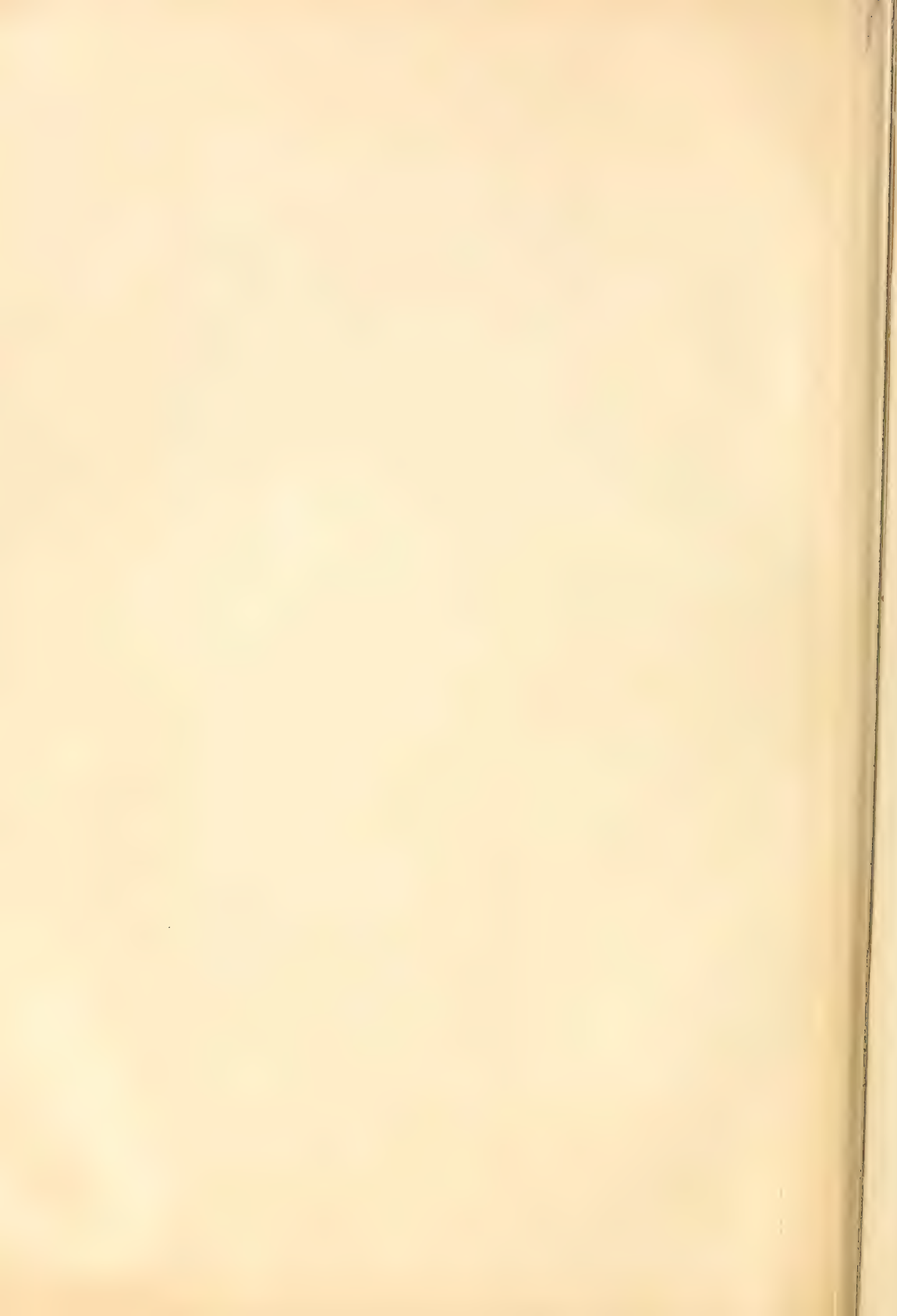
Star Cluster G.C. 4294 after Trouvelot.



Star Cluster G.C. 4440 after Vogel.



Star Cluster G.C. 1361 after Vogel.



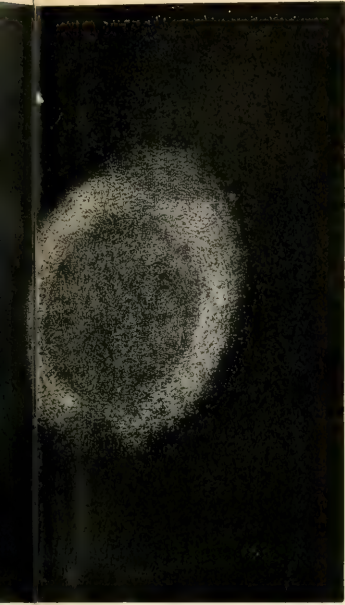




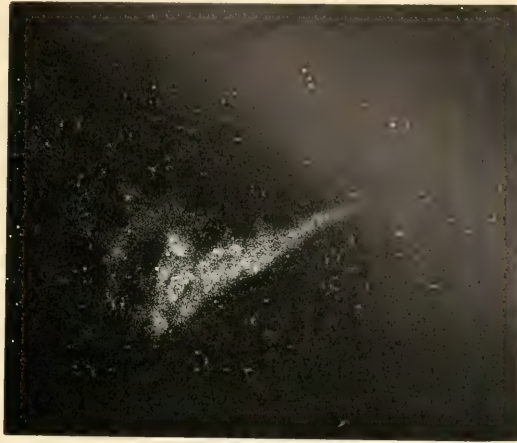
Rt. Asc.  $19^{\text{h}} 55^{\text{m}}$  Decl.  $+ 37^{\circ} 45'$ .

Part of the constellation of the Swan (Cygnus).

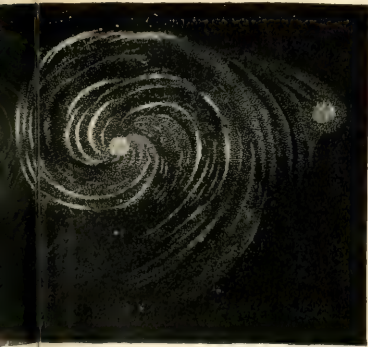
Heliographical reproduction from a photograph by the Brothers Henry of Paris,  
without modification.



Ring Nebula in the Lyre (Lyra)  
after Holden.  
G. C. 4447.



The Omega Nebula after Holden and Trouvelot.  
G. C. 4403.



Spiral Nebula  
in the Canes Venatici after Rosse.  
G. C. 3572.



Crab Nebula in the Bull (Taurus)  
after Rosse.  
G. C. 1157.





G. C. 256, in Cassiopeia.

G. C. 392, in Cassiopeia.



G. C. 4230, in Herkules.

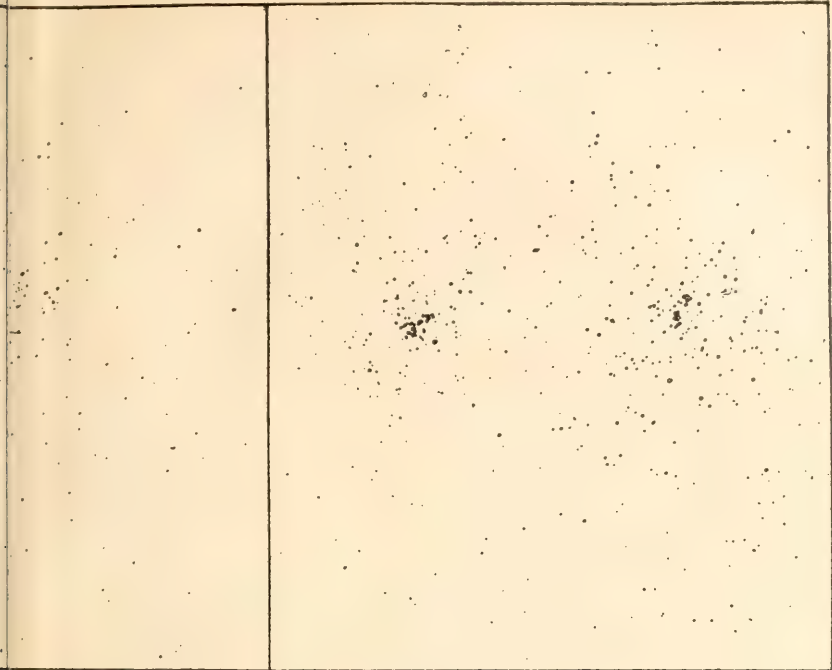
G. C. 4755, in the Lyra.

Printed in Germany, by Süssner.



Cassiopeia.

G. C. 512, 521, in Perseus.



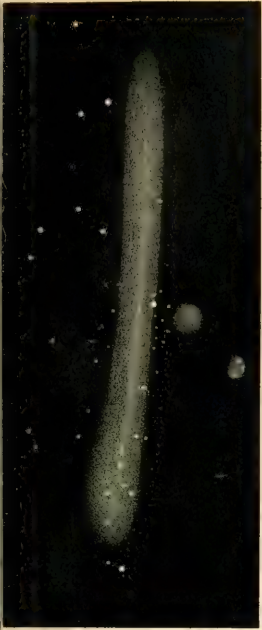
Lizard (Lacerta).

G. C. 5031, in Cassiopeia.









Nebula G.C. 3165 after Tempel.

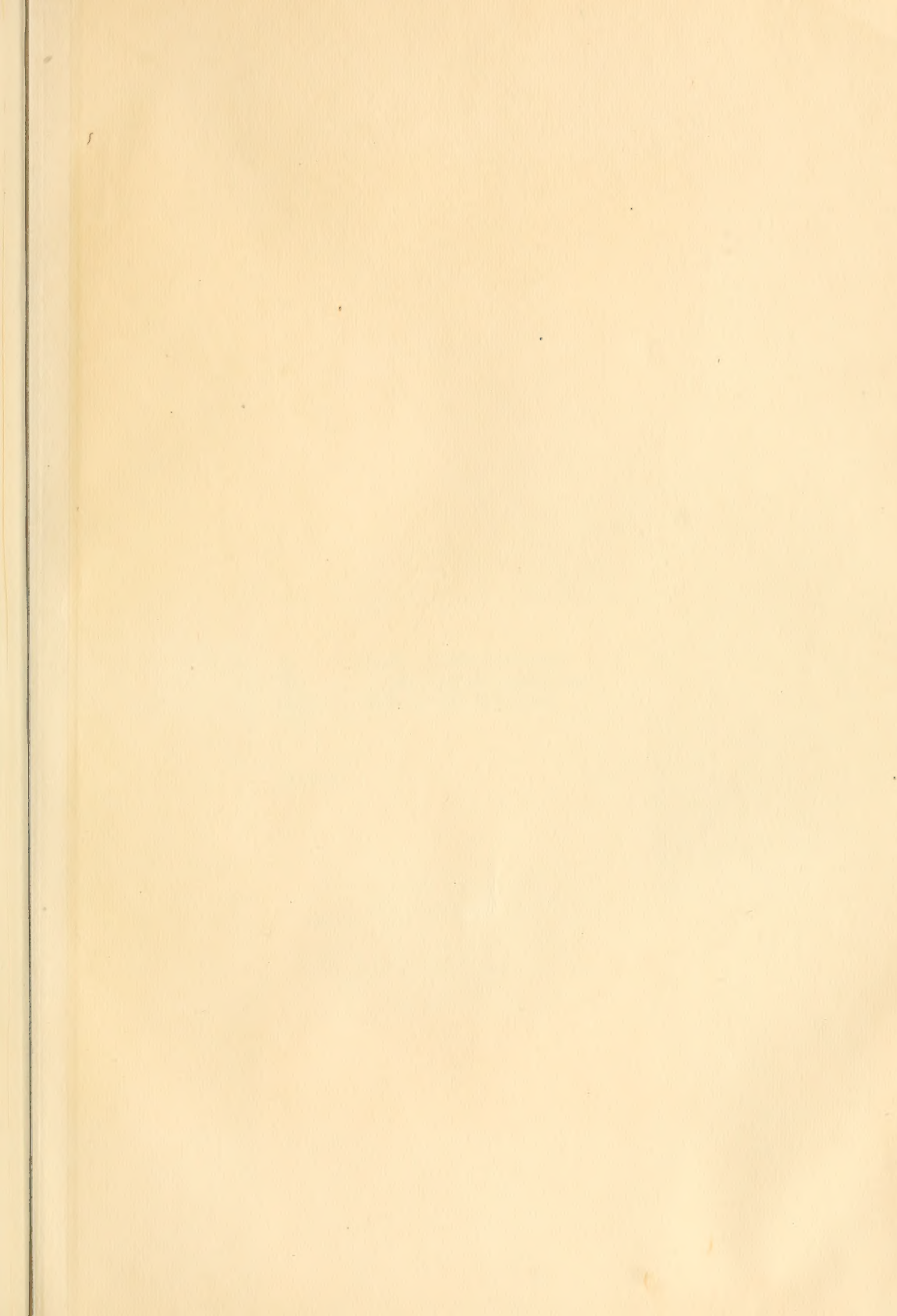


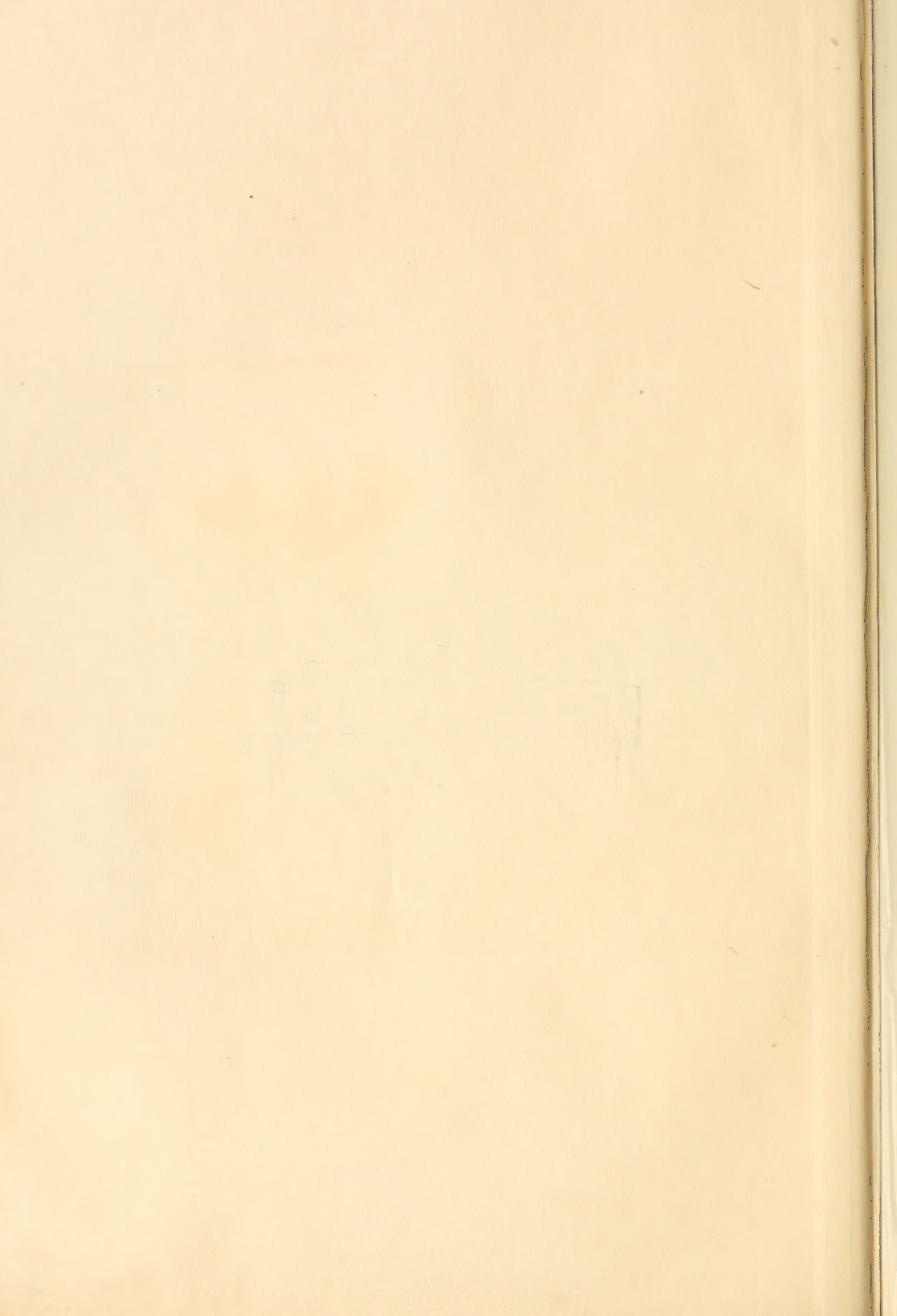
Star Cluster G.C. 1295 after O. Lohse.



Star Cluster G.C. 4230 after Trouvelot.









QB  
65  
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1901

Klein, Hermann Joseph  
Star atlas containing  
maps of all the stars

P&ASci

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